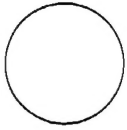


# Designing Emotions

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Pieter Desmet

TR 3893



Pieter Desmet  
*Designing Emotions*

[www.DesigningEmotion.nl](http://www.DesigningEmotion.nl)

Cover design and lay-out: Sanne van Rooij [S5]

Cover photo: Talea Bohlander

Photos in colour were made by participants of Study 9 (see Chapter 7).

The puppets on the left pages represent a selection of PrEmo animations (see Section 3.5 of Chapter 3).

ISBN 90-9015877-4

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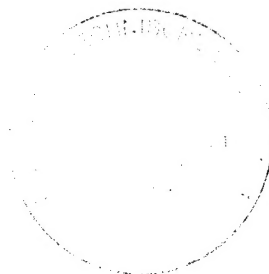
# Designing Emotions



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## *Proefschrift*

ter verkrijging van de graad van doctor  
aan de Technische Universiteit Delft,  
op gezag van de Rector Magnificus prof. dr. ir. J.T. Fokkema,  
voorzitter van het College voor Promoties  
in het openbaar te verdedigen op dinsdag 25 juni 2002 om 14.00 uur  
door Pieter Marc Andries DESMET  
ingenieur Industrieel Ontwerpen  
geboren te Izegem, België





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*Dit proefschrift is goedgekeurd door de promotor:*

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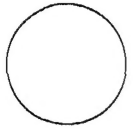
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Dr. C.J. Overbeeke heeft als begeleider in belangrijke mate aan de totstandkoming van het proefschrift bijgedragen.





Reason is, and ought to be, the slave of the passions.

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*David Hume*



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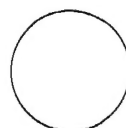
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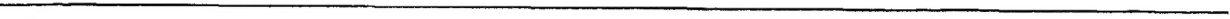
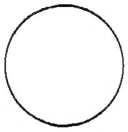
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# Introduction



This thesis is about emotions – emotions elicited by products. It is about our sometimes-irrational desire to buy a product for which we honestly have no use. It is about being inspired by a stunning new car model, and about being bored with yet another (similar) mobile telephone. It is also about the melancholy evoked by the toys we played with as children, and about the contempt (or admiration) we may feel towards our neighbour's doll collection. Questions addressed in this thesis are: 'How do products elicit emotions?' and 'How can designers influence these emotions?' Readers will discover that there are only a few, rudimentary, one-to-one relationships between a product's appearance and the emotions it elicits. However, they will also find that these emotions *can* be measured, and that there *are* general patterns in how products elicit emotions.

## Why study product emotions?

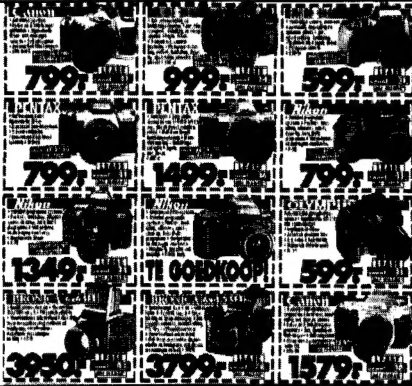
Cacioppo and his colleagues wrote that "emotions guide, enrich and ennoble life; they provide meaning to everyday existence; they render the valuation placed on life and property" (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2001, p. 173). This assertion illustrates that emotions play an important role throughout the span of our lives. A person's emotions enrich virtually all of his or her waking moments with either a pleasant or an unpleasant quality (Diener, Sandvik, & Pavot, 1991). Many studies have shown that emotions have a strong influence on our general experience of well-being, i.e. people's own evaluation of their lives (see Diener & Lucas, 2000). In addition, it is widely acknowledged that a substantial part of our emotions is elicited by 'cultural artefacts' (e.g. art, clothing, and products, see e.g. Oatley & Duncan, 1992). Similarly, in consumer research, emotions are often found to strongly influence satisfaction (Hirschman & Holbrook, 1982).

There is also a second, more commercial reason for this research. Nowadays, it is often difficult to distinguish products on the basis of their technological functioning or quality. In most markets, product differentiation is difficult because products are similar in respect to their technical characteristics, quality and price (e.g. Dumaine, 1991, Thackara, 1997; see Figure 1). As a result, present-day advertisements often focus on the 'emotional benefits' rather than on the functional or technological benefits of buying or owning a particular product (see Figure 2). Emotional responses can incite the customer to pick a particular model out of the row. Moreover, given that the first impression of a product strongly influences purchase decisions (e.g. Creusen, 1998), emotional responses to consumer products may be a decisive factor in purchase decisions.

Given the influence of emotions on both our well-being and our purchase decisions, it seems evident that both knowledge of how products elicit emotions and tools to evaluate the emotional impact of a product design can be of use for the design practice. So far, however, little is known about how people respond emotionally to products and what aspects of a design trigger an emotional reaction.



Figure 1 Differentiating between products.



### Object of study

The concept of product emotions is broad, and is not characterised by clear boundaries. Product design and product usage involve, evoke, and influence our moods, feelings and emotions in many different ways. Simply looking at a product can elicit an emotional response. For instance, one can experience aesthetic desire towards some beautiful product design. Also, the utilitarian aspects of products involve affective responses. One's mood, for example, can be changed for the worse by a printer that doesn't seem capable of printing one paper at a time. These are just a few examples, and many more like these can be produced. One can be happy about owning a particular product (or jealous because someone else owns it), sad about breaking it, amused when using it, etcetera. In fact, all of these can be considered as different types or classes of product emotions. The object of study in this thesis is restricted to one particular type of product emotions, i.e. *emotions elicited by product appearance*. This focus is illustrated with the anecdotal example of 'Thomas and his espresso machine.'

#### *Thomas and his espresso machine*

*Thomas is downtown, shopping for an espresso machine. Tomorrow it will be his girlfriend's birthday and he wants to surprise her with her favourite morning drink: a fresh cappuccino. As he doesn't know which one to choose, he has taken along his sister Anne to advise him. He has explained to her that he wants a machine that has a milk-foam function – to make the cappuccino. This is his only demand. Anne knows better; she knows her brother well enough to anticipate that he'll leave the store with the machine that has the most shiny buttons and meters. In the store, she advises Thomas to buy a blue model with a nice cheerful expression. Thomas feels contemptuous towards this model because, in his eyes, it looks childish. Contrarily, he admires a model made of*

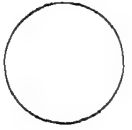


Figure 2 Emotional benefits.

"He got his cheerful look  
from his Charade."



stainless steel for its professional expression, but is disappointed to find that it doesn't have a milk-foam function. Suddenly his eye falls on a glossy, chromium-plated machine that looks like a small factory! Although Anne is amused by all its meters (of which most are probably superfluous), Thomas instantly feels a strong desire to try this one out. To his pleasant surprise it makes all kinds of loud sizzling noises, which add to his inspiration. Anne, however, is mainly indignant when she discovers the amount of muscle-power that is required to operate the thing. There is no use in arguing, however, because the choice has been made. The next day, Thomas can't wait to see the response of his girlfriend. But first, he wants her to guess what her present is. Her response is: "hmmm, whatever it is, I hope it doesn't have too many shiny buttons."

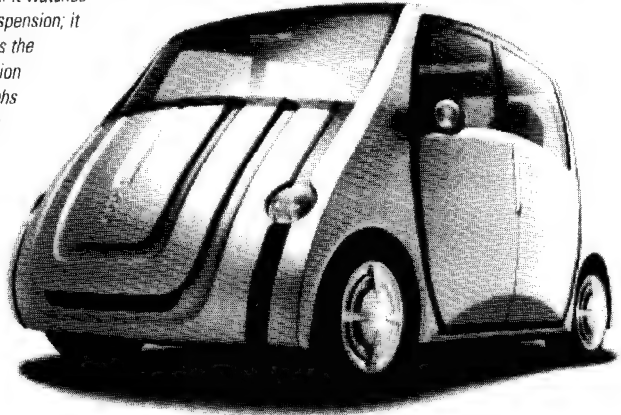
### Expression versus impression

A first clear distinction in product emotions is between those *expressed* by products and those *elicited* by products. A remarkable example of the first type is a recently launched small car (see Figure 3). This car was designed to express various emotions. It smiles when approached and looks sad when abandoned by the 'master.' Another, less extreme, example is the always cheerful vacuum cleaner 'Henry' in Figure 4. The second type of product emotions are those that we experience towards products. This second type is the focus of the current study. Obviously, there is not a one-to-one relationship between the two kinds of product emotions. For instance, in spite of the blue espresso machine's cheerful expression, Thomas felt contemptuous rather than cheerful.



**Figure 3 The p.o.d.; an emotional car.**

*"The car 'smiles' when you approach. It watches your driving style and adjusts the suspension; it takes note of your mood and changes the thermostat. And when the conversation seems to be going well, it photographs the memory for you. It even wags its antenna to let you know it's happy."*



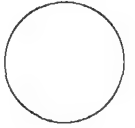
### **Seeing versus consuming**

The anecdote illustrates that products can elicit emotions not only by their appearance (e.g. "what a fascinating machine"), but also by 'consuming the product.' For example, the act of buying a product can elicit strong emotions (e.g. Richins, 1997). In addition, the act of using a product can elicit strong emotions. One can, for example, experience strong emotions when playing with a video game. And finally, one can also experience emotions by the 'act' of owning a product (e.g. being ashamed of owning an old car, or being happy about owning an old-timer). The focus of the current research is centred on 'emotions elicited by the appearance of durable products.' Product appearance is used to indicate all the product characteristics that people can perceive by looking at, touching, hearing, tasting, and smelling a product, i.e. product shape, texture, taste, colour, etcetera.

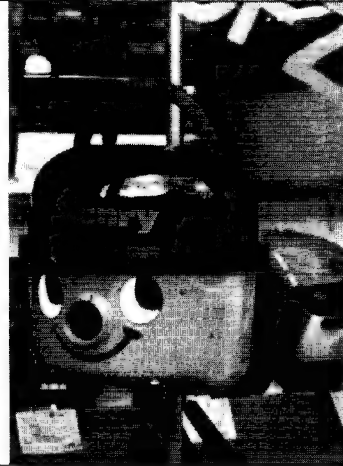
### **Product emotions**

The anecdote also illustrates some characteristics of emotions elicited by product appearance. First, it shows that these emotions are personal, that is, different people experience different emotions towards the same product. Anne felt indignation towards the chromium-plated espresso machine, whereas Thomas felt desire and inspiration. A third person may have felt yet another emotion or, perhaps, no emotion at all. Second, the anecdote also illustrates that emotions are temporal. One person may experience different emotions towards one given product at different points in time. Although, at first, Anne was amused by the chromium-plated model, later she felt contemptuous towards that same model. Third, the anecdote illustrates that emotions can be mixed, that is sometimes we feel more than one emotion simultaneously. Because products are complex objects different aspects or features





*Figure 4 Vacuum cleaner 'Henry.'*



can elicit different emotions. Thomas, for example, felt both admiration and disappointment towards the stainless steel model.

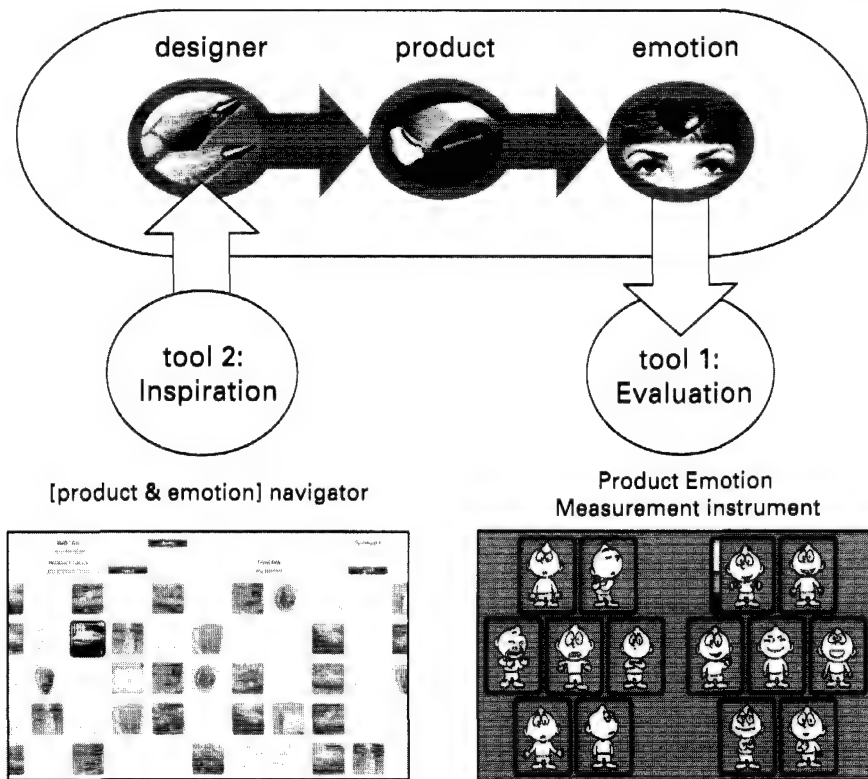
### **Research tradition**

After being neglected for many years, a sudden interest in emotional responses elicited by consumer products has emerged. The affective side of product experience has become a 'hot topic,' which is probably best illustrated by conferences and events over the past few years (see e.g. Green & Jordan, in print; Harada, 2002; Overbeeke & Hekkert, 1999). A difficulty of affective concepts such as emotion is that they are probably as intangible as they are appealing. Although some interesting and promising studies have been reported, the research field is still short of conceptual clarity, and therefore lacks consensus on what the actual object of study should be. In fact, the concept of emotion has been somewhat vague and has been used as a collective noun for all kinds of affective phenomena. Design literature tends to refer to 'emotions' when studying anything that is thought of intangible, non-functional, non-rational or, for that matter, non-cognitive. Some of the reported studies involve 'experiential needs' (Holbrook, 1985), 'affective responses' (Derbaix & Pham, 1991), 'customer delight' (Burns, Barrett & Evans, 2000), 'pleasure' (Jordan & Servaes, 1995), 'emotional behaviour' (Wensveen, Overbeeke, & Djajadiningrat, 2002), and 'affective computing' (Picard, 1997).

Emotions have also been studied in other fields of research. In the last 10 years, researchers in the field of consumer behaviour have studied a broad variety of affective responses in the consuming experience. Examples are – affective responses to consuming situations (e.g. Derbaix & Pham, 1991), the relationship between emotions and post-purchase attitude (e.g. Westbrook & Oliver, 1991), emotions towards

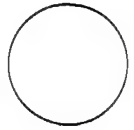


Figure 5 Two tools developed in the 'designing emotion' research.



commercials (e.g. Bagozzi, Gopinath, & Nyer, 1999), and general post-purchase affective responses (e.g. Westbrook, 1987). Note that, although all of these studies have found emotions to be an important component of consumer response, emotions elicited by product appearance are generally ignored in consumer research.

For the current research, theoretical starting-points have been drawn from models and theories found in the psychology literature. Naturally, psychology has a long tradition in the study of emotions. In 'mainstream' emotion psychology, the object of study is emotions in general, or particular emotions such as disgust (Rozin, Haidt, & McCauley, 2000), or happiness (Averill & More, 2000). A special case is the topic of 'aesthetic emotions,' i.e. emotions elicited through a stimulation of our senses by things like works of art or natural landscapes. Some researchers focus specifically on emotions elicited by music, for example (e.g. Kivy, 1980), or emotions elicited by films (e.g. Tan, 1995b).



**Figure 6 Expressing emotion.**

*Cartoon proposals, drawn by Dutch cartoonist Gerrit de Jager.  
What are the emotional responses of these puppets towards the product they are looking at?*



### **Aim & structure of this thesis**

The project was designed to clarify the relationship between product appearance and the emotional responses elicited by products. It was initiated by a question from Mitsubishi Motor R&D. This company acknowledges the relevance of emotional responses in the field of automotive design and was interested in knowledge and tools to support automotive designers in manipulating the emotional impact of their designs. Although this question served as a starting-point, the research was not focussed on automotive design (or any other predefined product class) but rather on product appearance in general.

The main goal was to develop a model that will explain how products elicit emotions, and two tools that will support designers. Figure 5 shows the purposes of the two tools that have been developed. The first tool (i.e. the Product Emotion Measurement instrument or PrEmo) was developed to support designers in evaluating the emotional responses towards existing and new designs. The second tool (i.e. the [product & emotion] navigator) was developed to support designers who want to manipulate the emotional impact of their designs.

#### **(2) The Product Emotion Measurement Instrument.**

Companies such as Mitsubishi operate on a global market and therefore require instruments that can be applied cross-culturally. This was one of the main requirements in the development of PrEmo. PrEmo is a non-verbal, self-report instrument that measures 14 emotions which are often elicited by product design. Instead of relying on the use of words, respondents can report their emotions with the use of a set of 'cartoon' animations, each expressing one of the 14 product relevant emotions. Cartoon animations have been used because these are often particularly efficient in portraying emotions (see Figure 6). These animations were developed with the aim of making them unambiguous and recognisable across cultures. Given



the requirement of cross-cultural application possibilities, PrEmo was validated in various countries (i.e. The Netherlands, Japan, Finland and the USA). PrEmo is reported and discussed in Part B of this thesis.

## (2) The [product & emotion] navigator.

Whereas PrEmo supports designers in the evaluation of the emotional impact of their designs, the [p&e] navigator supports designers before and during their design process. The [p&e] navigator is an inspirational and educational tool that visualises general patterns in the process of how products elicit emotions. In the [p&e] navigator these patterns are visualised with the use of an abundant amount of (hundreds) examples of products that elicit particular emotions. The theoretical basis of this tool is the 'model of product emotions.' This model distinguishes three key-variables in the eliciting conditions of product emotions that can be used to explain how products elicit emotions, and why particular products elicit particular emotions. The [p&e] navigator was developed to be inviting, open-ended, and intuitive in use.

## Thesis outline

The thesis is divided into three parts to facilitate those who may want to restrict their readings to a particular topic of interest to them. Moreover, the chapters have been written in a way that allows readers to read them in the sequence of their preference. For this reason, the introduction to each chapter briefly summarises the major conclusions and discussions of the preceding chapters.

### Part A – defining emotions.

In the first two chapters emotions and 'product emotions' are described and defined. In Chapter 1, the psychologist's literature on emotions is reviewed, to examine what constitutes an emotion and define the concept of product emotion. Emotions are distinguished from other affective states such as moods and sentiments, and different approaches in differentiating emotions from one another are discussed. The main conclusion of Chapter 1 is that product emotions are not a special type or class of emotions, but are as 'real' as the emotions we experience in response to our social context. In Chapter 2, some empirical studies are reported that were performed to establish which emotions are (and which are not) relevant for the experience of product appearance. The result of this investigation is a set of 41 'product relevant emotions,' i.e. emotions that are often elicited by product design. This set is classified into eight emotional categories.

### Part B – measuring emotions.

In the second part, the development, validation and application of PrEmo is reported. In Chapter 3, existing instruments are reviewed, and the development of PrEmo is

This image is a 10x10 grid of 100 small, square, high-contrast black and white photographs. Each photograph depicts a different object or scene, often featuring strong highlights and deep shadows. The subjects are diverse, ranging from everyday items like a light bulb, a bicycle, a teapot, and a pair of scissors, to more abstract or unusual figures like a person in a dark suit, a figure in a white mask, and a figure in a dark hood. Some images show vehicles like cars and motorcycles, while others depict architectural elements or natural scenes. The overall effect is a dense collection of visual stimuli, each presented in a stark, graphic style.



reported. The design process of this instrument involved six different versions, each of which is briefly discussed. Subsequently, in Chapter 4 the studies performed to validate the instrument are reported. Chapter 5 reports a cross-cultural application study that was conducted with PrEmo. In this study, emotions elicited by six car models were measured, both in Japan and in The Netherlands. In the discussion section of that chapter some interesting differences between the Japanese and Dutch responses are discussed. The chapter also examines how product specific 'emotion profiles' can be created with the use of data obtained with PrEmo.

#### Part C – designing emotions.

In the final part the attention is shifted to the questions 'how are emotions elicited?' and 'how can a designer manipulate the emotional impact of his or her designs?' First (in Chapter 6), a general model of product emotions is reported that sets out the major variables that determine if a product elicits emotions and, if so, which emotions are elicited. In Chapter 7, on the basis of this general model, the eliciting conditions of a set of product relevant emotions is explored in detail with the use of a 'photo-study.' In this study, respondents took photos of products that, in their daily environments, elicit particular emotions. Figure 7 shows some examples of these photos. For each of the 14 emotions that were measured by PrEmo, patterns of eliciting conditions are reported, and illustrated with examples drawn from the photo study. Subsequently, Chapter 8 reports the application of the model in a workshops. In addition, the [product & emotion] navigator is reported and applied in a 'mixed emotions' workshop.

Note that, although interesting, the relationship between emotional responses towards product appearance and behaviour (such as purchase and usage behaviour) has not been the object of this study. In the final part of the thesis, i.e. the general discussion, the implications of this research for the field of design research are discussed. In addition, in this chapter, it is discussed how the three distinct results of this research (i.e. the model, PrEmo and the [p&e] navigator) are related to one another, and how they can be integrated and applied in design practice.

# Part A

## Defining Emotions







## 1.1 Introduction

*What is an emotion?* This may seem a superfluous question. After all, we all 'know' what an emotion is. That is, until we are asked to give a definition. Then we find that, although the concept of emotion appears to be generally understood, it is surprisingly difficult to come up with a solid definition. This is best illustrated by Young's conclusion that "almost everyone except the psychologist knows what an emotion is" (Young, 1973). In order to assess whether, and how, emotions are relevant for the field of design (research), we should first examine what constitutes an emotion and define the concept of product emotion. To that end, Chapter 1 examines current perspectives in psychology, defines the phenomenon 'emotion,' and discusses its nature.<sup>1</sup>

The major question that underlies the examination of the phenomenon 'emotion' is whether or not emotions elicited by products are 'real' emotions. Real (or *genuine*) emotions are those that we experience towards important events in our lives, such as the desire we may feel to be in the company of someone we love, or the anger we feel towards someone who demeans us (e.g. Lazarus, 1991). If product emotions are genuine emotions, then the desire we feel to own a beautifully designed watch, and the indignation we feel about an expensive mobile telephone's impractical tiny buttons, should be similar to the desire and anger described above. Are product emotions genuine or are they in fact a 'special type' of emotion? To enable us to answer this question, in each of the subsequent sections a distinct issue concerning the nature of emotion is discussed.

Section 1.2 describes how emotions can be distinguished from other types of affective states, such as moods and sentiments. Section 1.3 goes on to describe three major traditions in the research of emotions, each with different propositions about the emotion process. These traditions are reviewed in order to find an answer to the question of *how* emotions are elicited. Section 1.4 describes the different approaches employed to distinguish one emotion from another. In the final section, Section 1.5, conclusions are drawn about the concept of product emotions, and the implications for the current research are discussed.

## 1.2 Affective states

The word 'emotion' is often applied to a wide variety of phenomena, such as passions, sentiments, temperament, and moods. Although these words are regularly used interchangeably, they do in fact refer to specific and different experiential phenomena. For this reason, in this section these phenomena are defined and distinguished on the basis of the research literature. In this thesis, the word 'affect' (or affective state) is used to comprise all these phenomena. The affective states described in this section are: emotions, moods, sentiments and emotional traits. This discussion is followed by an account of the decision to focus the current research on the affective state 'emotions.'



**Table 1-1 Differentiating affective states (after Frijda, 1994).**

	Intentional	Non-intentional
Acute	Emotions	Moods
Dispositional	Sentiments	Emotional traits

The research literature shows that in general two approaches are used to distinguish between different types of affective states. Affective states can be distinguished either by observable characteristics (e.g. intensity), or by the conditions that give rise to them (e.g. origins). Because the interest of the current research is in emotions with a given origin, i.e. product appearance, the second approach, based on eliciting conditions, seems most relevant. This approach identifies two important aspects of difference between affective states: (A) whether or not the state involves a relation between the person and a particular object (i.e. intentional versus non-intentional), and (B), whether the state is acute or reference is made to a more or less enduring disposition (i.e. acute versus dispositional).

On the basis of these two aspects, Table 1-1 represents an overview of four different affective states. Note that 'feeling' is not included, because it is not considered to be a distinct affective state. Rather, feeling is considered to be a component of, i.e. the conscious experience of, an emotion (see Section 1.3).

(A) Intentional versus non-intentional states

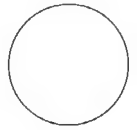
States that involve a relationship between the person and a particular object are intentional, whereas those that do not involve such a relationship are non-intentional. Note that the *object* of a state and its *cause* (stimulus) may be different entities. For example, the *object* of one's admiration might be a designer, and the *cause* would be the designers' outstanding product designs. Both emotions and sentiments are examples of intentional states. Conversely, moods and emotional traits are non-intentional.

(B) Acute versus dispositional states

States that are limited in time are acute. Whether their persistence is short (emotions) or long (moods), acute states have by definition a time-limited manifestation. States that are *not* limited in time, such as emotional traits and sentiments, are by definition enduring dispositions. In contrast to acute states, dispositions have no identifiable beginning or ending.

(1) Emotions

Emotions are intentional because they imply and involve a relation between the person experiencing them and a particular object: one is afraid *of* something, proud



of something, in love *with* something and so on (Frijda, 1994). In addition, people are usually able to identify the object of their emotion (Ekman & Davidson, 1994). We know *who* we love, and we know with *whom* we are angry. Besides being object-related, emotions are acute, and exist only for a relatively short period of time. Usually, the duration of an emotion is limited to seconds, or minutes at most (Ekman, 1994c). The cause that elicits an emotion (the stimulus) can be an event in the environment (e.g. someone calling our name, catching sight of an object), or some change within us, such as thoughts or memories (Ekman, 1994c). Note that in some particular cases a person may be unaware of the cause of their emotion. They might be angry with their spouse without knowing the precise cause of the anger, or fascinated by a product without knowing the reason for its fascination.

#### (2) Moods

Moods tend to have a relatively long-term character. One can be sad or cheerful for several hours or even for several days. Nevertheless moods, like emotions, are acute states that are limited in time. The main difference between moods and emotions is that moods are essentially non-intentional (e.g. one is not sad or cheerful at something). Moods are not directed at a particular object but rather at the surroundings in general or, in the words of Frijda (1994, p. 60), at "the world as a whole." Whereas emotions are usually elicited by an explicit cause (e.g. some event), moods have combined causes (e.g. "It is raining," "I didn't sleep well," "Someone has finished the coffee!"). Consequently, we are generally unable to specify the cause of a particular mood (Ekman, 1994c). A person is sometimes not even aware of being in a certain mood (e.g. if we are grumpy in the morning we usually only realise it when someone else tells us).

#### (3) Emotional traits

Traits are long-term-dispositional personality characteristics. Emotional traits can be interpreted as moods that are characteristic for a certain person: one can have a cheerful or a gloomy *character* (Watson & Clark, 1994). Moods and emotional traits are distinguished by their duration: while everyone has a grumpy mood from time to time, not everyone has a grumpy character. Moods and emotional traits are sometimes confused because the same words are often used to express traits as well as moods (e.g. 'this is a cheerful person' versus 'this person is cheerful today'). Emotional traits are, like moods, non-intentional because they are not directed at a specific object but at the world in general.

#### (4) Sentiments

Like emotional traits, sentiments are dispositional states that may persist throughout a lifetime. The main difference between sentiments and emotional traits is that, like



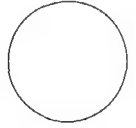
emotions, sentiments involve a person-object relationship. Our sentiments are our likes and dislikes, or our attitudes towards particular objects or events (Frijda, 1986; see also Chapter 6). Some examples of sentiments are "I am afraid of dogs" or "I love ice-cream." These examples illustrate that sentiments can easily be confused with emotions. Nevertheless, according to Frijda (1994), being afraid of dogs (sentiment) and being frightened by a dog (emotion), are essentially different states. Naturally, we also have sentiments regarding products, such as a dispositional love for Citroën 2CVs, or a dispositional dislike for mobile telephones.

### Product emotions

An important aspect of emotions discussed in this section is the distinction between the emotion's cause and object. These are not necessarily the same. Sometimes, a product is the object of our emotion, sometimes the product is the cause, and sometimes it is both. Take the example of Anne and Thomas and an expensive sailing boat. Anne may feel contempt because for her it is an irresponsible waste of money. Thomas, on the other hand, feels enthusiasm when he thinks of the enjoyment to be had on those long summer days. Although the *cause* of Anne's emotion is the boat's excessively luxurious design, the *object* of her contempt is probably not the boat itself but rather the person who chooses to buy it. On the other hand, the *object* of Thomas' enthusiasm is the boat's design, whereas the enthusiasm is *caused* by the anticipated joyful summer days.

Note that although the focus of the current research is on emotions, this does not imply that other types of affective states are irrelevant for product experience. In fact, the preceding discussion illustrated that the various types of affective states influence each other. Obviously, our emotions are influenced by our moods. For instance, a person in an irritable mood becomes angry more readily than usual (Ekman 1994c). In the same way, a person's emotional response to products may vary depending on their mood. Consumer researchers found that moods have a strong influence on consumer behaviour (e.g. Gardner, 1985; Faber & Christenson, 1996). Someone who is cheerful will be attracted to products more readily than someone who is in a bad mood. Conversely, emotions also influence our moods. A person who is repeatedly disappointed by a malfunctioning computer may very well end up in a bad mood. In the same way, it is not difficult to imagine that our emotional traits can also influence our emotional responses towards products. Someone who is known for his grumpy character will probably more often experience dissatisfaction with products than someone with a cheerful character.

The aim of the current research is to find relationships between product appearance and emotions. The influences of both moods and emotional traits on our emotional responses to products are independent of product appearance. A person in



a cheerful mood will experience more pleasant emotional responses towards products in general –regardless of the particular appearance of the product. For this reason, both moods and emotional traits are not included as variables in the current research. Note, however, that this discussion does not apply to the fourth type of affective states: *sentiments*. Like moods and emotional traits, sentiments influence emotions. An important difference, however, is that this influence is *not* independent of product appearance. In fact, the influence of our sentiments (or dispositional likes and dislikes) on our emotional responses to products strongly interacts with the appearance of those products (see e.g. Ortony, Clore, & Collins, 1988). Take Anne's love of small cars. This sentiment will have a positive influence on her emotional response towards a Mini Cooper and a negative influence on her emotional response towards a Fiat Multipla. Given this strong interaction between sentiments and product appearance, this type of affective state has been given a prominent place in the 'model of product emotions' presented in Chapter 6.

### 1.3 Traditions in the research of emotion

When surveying emotion research in psychology, one finds various traditions that hold different views on how to go about defining, studying and explaining emotions. As a result, the answer to the question "how are emotions elicited?" strongly depends on whom you ask. Most contemporary emotion research has its roots in one of three major theoretical traditions: the evolutionary, the bodily-feedback, or the cognitive tradition.<sup>2</sup> It is important to have a basic understanding of these traditions, because each has its own perspective on how emotions are elicited. Therefore, this section comprehensively discusses the three major traditions and evaluates their possibilities for explaining how products elicit emotions.

#### (1) The evolutionary perspective on emotions

The evolutionary perspective has its roots in Charles Darwin's theory of evolution. In his famous work 'The expression of the emotions in man and animals' (Darwin, 1872), he described emotions in the context of natural selection. His major claim is that emotions are *functional* for the survival of the species and the individual. This function is adaptive: when an individual is engaged in some behavioural action, an emotion will overrule this action with another action if this action ensures the safety of this individual. Or, in the words of Plutchik (1980, p. 129), the function of emotions is to help "organisms to deal with key survival issues posed by the environment." An example of this process can be observed when the fire alarm is activated: everyone immediately stops whatever they're doing and heads for the exit. In this case, fear initiates an impulse to flee in order to survive a threatening situation.

Researchers in this tradition regard the adaptive behaviour (including facial expressions and states of readiness to respond) as central to what emotions are.



Plutchik (1980), for example, proposed that each emotion represents a specific behaviour, which is related to one of our basic needs, such as protection (*fear*), reproduction (*happiness*), or exploration (*surprise*). The assumption that emotions are evolved phenomena implies that their accompanying manifestations should be universal. Consequently, researchers adhering to the evolutionary perspective, such as Ekman (e.g. 1992) and Izard (e.g. 1994), have extensively studied cross-cultural universalities of emotional manifestations (e.g. facial expressions).

#### Product emotions in an evolutionary perspective

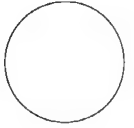
The theories developed by researchers working in the evolutionary tradition provide us with a basic understanding of *how* emotions are elicited. These theories clearly demonstrate the role of external stimuli (such as events or objects) in the eliciting conditions of emotions. Nevertheless, with these theories it is difficult to explain exactly how *products* elicit emotions. The reason for this is that these theories are typically focussed on the universal human emotions. Examples of such universal emotions would be the fear experienced when standing face-to-face with a tiger, and the happiness experienced when holding our new born child. However, our emotional responses to products are, in most cases, not universal. Towards the same sailing boat Anne felt contempt and Thomas felt enthusiasm. The models of emotions in the evolutionary perspective offer few clues to explain why two people may experience completely different emotions towards the same product.

Not all product emotions can be directly related to universal basic needs like survival and reproduction. In many cases it requires some imagination to use one of our basic survival issues as a basis to explain why a particular product elicits a particular emotional response (e.g. inspiration elicited by the design of a new computer).

### **(2) The bodily-feedback perspective on emotions**

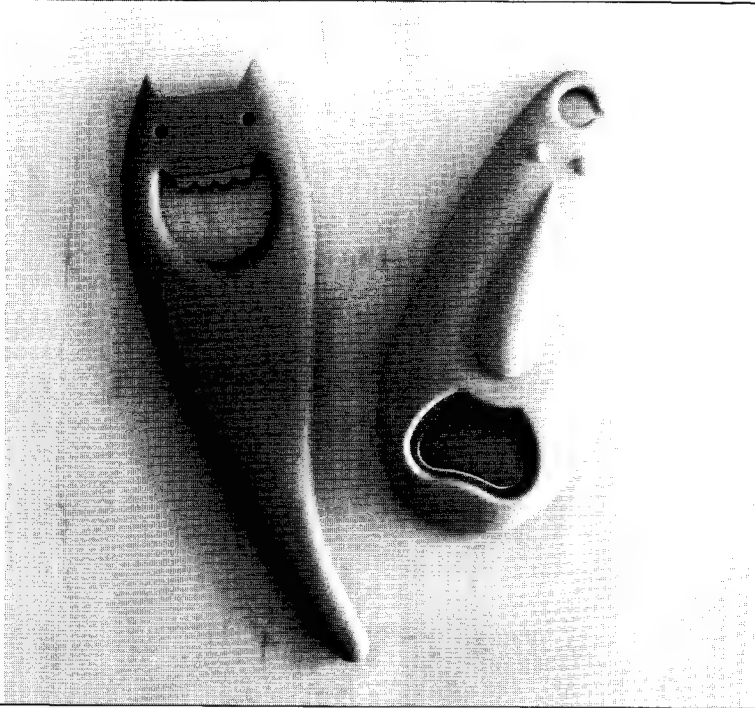
Whereas the evolutionary perspective focuses on the *function* of emotions, the bodily feedback perspective is primarily concerned with the emotional *experience*. The pioneer of this tradition, the philosopher/psychologist William James, placed the body at the centre of the emotional experience. He was convinced that the involvement of the body is essential for having emotions. In his view, the experience of an emotion is a direct result of a 'bodily change,' and he argued that this change *is* the emotion (James, 1884, 1894). From this perspective, emotions are not only the outcome of, but are also differentiated by, bodily changes.

Although James was not entirely clear what he meant by the term 'bodily change,' most modern interpretations take it to mean either an expression (see Laird & Breiser, 1990), or an increase in autonomic nervous system activity (see Grings & Dawson, 1978).<sup>3</sup> In the case of fear, for example, we first start to shiver and our pulse rises, and then we perceive these reactions as being afraid.



**Figure 1-1 Emotional expressive products.**

*Two bottle  
openers;  
which one do  
you prefer?*



#### Product emotions in a bodily-feedback perspective

One of the most challenging predictions stemming from the bodily-feedback perspective is that if a person copies a certain emotional expression, this person will actually experience this emotion (e.g. if you force yourself to smile during an unhappy mood then you will automatically start to feel happier; see Strack, Stepper, & Martin, 1988). This could explain why products sold by Alessi, a company well-known for designing kitchenware products with emotional expressions, all have *happy* faces.

As discussed in the introduction to this thesis, this type of product emotions, i.e. emotions expressed *by* the product, although interesting are not the objects of this current study. For an explanation of how products *elicit* emotions, the bodily-feedback tradition seems to offer only few possibilities. The reason for this lies in the fact that this theory does not explain the role of external stimuli in the elicitation of emotions. Moreover, many psychologists assert that the idea that emotions are based only on the awareness of a bodily change is too simple (e.g. Lazarus, 1991; Frijda, 1986). Feedback from physiological responses alone will never account for all the possible emotions humans can experience.



### (3) The cognitive perspective on emotions

In this currently popular view, elements can be found of both the evolutionary and the bodily-feedback perspectives. The essence of this perspective is that in order to understand emotions, one must understand how people make judgements about events in their environment, for emotions are generated by judgements about the world.

Magda Arnold, the pioneering psychologist of the cognitive view of emotions, argued that an emotion *always* involves an assessment of how an object may harm or benefit a person (Arnold, 1960). In the cognitive view, the process of emotions is explained by the process of *appraisal*. According to Arnold (1960, p. 175), an appraisal, “the direct, immediate sense judgement of weal or woe,” is at the heart of every emotion. Without appraisal there can be no emotion, for all emotions are initiated by an individual’s appraisal of his or her circumstances.

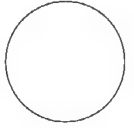
An important aspect of this perspective is that it holds not the event, but the *meaning* the individual attaches to this event, responsible for the emotion. An example would be when a friend makes a derogatory remark about you. Depending on the meaning you attach to this remark you might experience *anger* (i.e. “I am being insulted”), or *amusement* (i.e. “This is a joke!”). Positive emotions are elicited by stimuli that are appraised as beneficial, and negative emotions are elicited by stimuli that are appraised as harmful. Most, if not all, contemporary researchers in the cognitive tradition of emotion hold that each emotion is elicited by a distinctive appraisal (Roseman & Smith, 2001; see also Section 1.4). In the theory of Lazarus (1991, p.122), the emotion *sadness* is always the outcome of an appraised “demeaning offence against oneself,” and *pride* of an appraised “enhancement of one’s ego-identity.”

#### Product emotions in a cognitive perspective

Of the three perspectives reviewed, the most promising for explaining product emotions is the cognitive. Like the evolutionary perspective, it considers emotions to be instrumental (i.e. emotions establish our position vis-à-vis our environment, pulling us toward certain people, objects, actions and ideas, and pushing us away from others). However, instead of using basic survival issues to explain how emotions are elicited, it uses a broader notion of possible benefits or harms.

A limitation is that, because of the central role given to cognition in the process of emotion, researchers in this tradition find it more difficult to distinguish emotions from non-emotions, e.g. ideas, attitudes or evaluations.<sup>4</sup> Nevertheless, its focus on appraised meaning allows us to explain why different people may have different emotions towards the same product. Take the example of the expensive sailing boat from the previous section. Anne experienced contempt because she *appraised* it as an expression of irresponsible money wasting. Thomas, on the other hand, experienced enthusiasm because he *appraised* it as an object that could provide a great





deal of pleasure. Thus, Anne and Thomas experienced different emotions because they attached different meanings to the same object.

Allied to the concept of appraisal, the cognitive perspective offers the best starting point for clarifying the emotion-eliciting powers of consumer products. The definition of Arnold (1960, p.182) is therefore adopted for the current research: emotion is "the felt tendency toward anything intuitively appraised as good (beneficial), or away from anything intuitively appraised as bad (harmful)."<sup>5</sup>

## 1.4 Differentiating emotions

Human beings exhibit an extensive repertoire of distinct emotions (such as *joy*, *sadness*, *fear* and *anger*). Evidently some emotions are more alike than others, e.g. compare *disappointed* versus *dissatisfied* with *desire* versus *disgust*. How can different emotions be distinguished from each other? The research literature shows three approaches in differentiating between emotions: (1) based on manifestations of the emotions (such as facial expressions and action tendencies), (2) based on the appraisals that precede emotions, or (3) based on underlying dimensions. In this section, these three approaches are discussed and their particular advantages and disadvantages are evaluated.

### (1) Differentiating emotions on the basis of their manifestations

In Section 1.3 we saw that in the last 100 years psychologists have offered a variety of definitions of emotion, each focusing on different *manifestations* or components of the emotion. There seems to be no empirical solution to the debate on which manifestation is sufficient or necessary to define emotions. At present, the psychologists' most favoured solution is to say that emotions are best treated as a multifaceted phenomenon consisting of several components (see Izard, 1977; Lazarus, Kanner, & Folkman, 1980). These components, i.e. behavioural reactions, expressive reactions, physiological reactions and subjective feelings, are discussed below.

- *Behavioural reaction* (e.g. running, or seeking contact) is the action or behaviour one engages in when experiencing an emotion. Emotions initiate behaviour in the form of *action tendencies* such as approach, inaction, avoidance and attack (Arnold, 1960). Fear makes one want to run; love makes one want to approach or caress, and so on. Frijda (1986, p. 70) proposed that actions like "crying out, mama! when faced by danger, uttering insults when being slighted, or constantly thinking of the other person when seriously in love," are also examples of emotional action tendencies.
- *Expressive reaction* (e.g. smiling or frowning) is the facial, vocal and postural expression that accompanies the emotion. Each emotion is associated with a particular pattern of expressions (Ekman, 1994b). For example, anger comes with a



fixed stare, contracted eyebrows, compressed lips, vigorous and brisk movements and, usually, a raised voice, almost shouting (Darwin, 1872; Ekman & Friesen, 1975).

- *Physiological reaction* (activation or arousal, e.g. increases in heart rate) is the change in activity in the autonomic nervous system which accompanies emotions. Emotions show a variety of physiological manifestations, such as pupil dilatation and sweat production.
- *Subjective feeling* (e.g. feeling happy or feeling inspired) is the conscious awareness of the emotional state one is in, i.e. the subjective emotional experience. Each emotion involves a specific feeling which is a basic, irreducible kind of mental element (e.g. Titchener, 1908). In his famous work, Frijda (1986, p.179) states that “feelings form the core characteristic that differentiates affective from non-affective experience.” Note that also in daily life, feeling is commonly seen as the essence of emotion (Dalkvist & Rollenhagen, 1989).

These components are, naturally, also visible in product emotions. Imagine Thomas who, in spite of never having seen a Ferrari in real life, is a devoted admirer of this car brand. Naturally, he visits the annual motor show. At the show, when confronted by a real Ferrari Barchetta, Thomas might experience the emotion of *desire*. This desire reveals itself in the following manifestations: his eyes (and mouth) are wide open (i.e. expression); he bends forward and stretches out his hands because he experiences the urge to touch the car (i.e. behaviour). At the same time, his heart doubles its speed and he begins to perspire (i.e. physiological reaction). And finally, he will be aware of his desire; he experiences his emotion (i.e. feeling).

Emotions can be distinguished from each other with one or more of these four components. For example, we know from experience that emotions such as fear and anger each come with a unique facial expression and feeling. Ekman (1992) is famous for his work with facial expressions. On the basis of this component, he distinguished between seven distinct emotions (see Table 1-2). Many researchers working with this approach (e.g. Watson, 1930; Tomkins, 1984; Plutchik, 1980), have assembled similar sets of emotions that are considered to be ‘basic,’ in the sense that they form the core of the repertoire of our emotions. All other -secondary - emotions we might experience are considered to be derived from this small set of basic emotions. This is analogous to the idea that some colours are primary and others are mixed (Plutchik, 1993). The basic emotion research has its roots in the evolutionary tradition (see Section 1.3). Consequently, basic emotions are generally seen as products of evolution and are therefore found in all cultures, and even in some animals (e.g. Ekman, 1994a). Table 1-2 displays the prevailing lists of basic emotions.

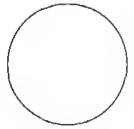


Table 1-2 Basic emotions.

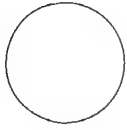
Ekman (1971)	Izard (1977)	Plutchik (1980)	Tomkins (1984)
-	-	Anticipation	-
-	Interest	-	Interest
Surprise	Surprise	Surprise	Surprise
Joy	Joy	Joy	Joy
Sadness	Distress	Sadness	Distress
Disgust	Disgust	Disgust	Disgust
Fear	Fear	Fear	Fear
Anger	Anger	Anger	Anger
-	Shame	-	Shame
Contempt	Contempt	-	Contempt
-	-	Acceptance	-
-	Guilt	-	-

The major advantage of this approach is that the manifestations of emotions can be *measured*. Therefore, all emotions that are distinguished (and differentiated) by this approach are, in one way or another, measurable. If, for example, it is known which unique facial expression accompanies the emotion *sadness*, it would be possible to assess whether or not a person is sad by measuring his or her facial expression. Because of this major advantage, this approach is applied in Part B of this thesis, for the development of an instrument to measure product emotions.

The major limitation of this approach is that (at this time) the only emotions that can be distinguished from each other are those listed in Table 1-2. These basic emotions may not represent all the emotions that are relevant for product experience. For example, these lists show a disproportionate concentration of *unpleasant* emotions. The researchers who deal with basic emotions typically identify only one pleasant emotion for every three or four unpleasant emotions (Ellsworth & Smith, 1988). Although several proposals have been made for relating secondary emotions to basic emotions (including fusing, blending, mixing, and compounding), no details are offered about how most pleasant emotions can be derived from the basic unpleasant (see e.g. Ortony & Turner, 1990). In short, with this approach it is unclear how emotions not included in Table 1-2 can be distinguished from each other.

## (2) Differentiating emotions on the basis of their preceding appraisals

A second approach to distinguishing between emotions is on the basis of the appraisals that precede them. In Section 1.3, there was discussion about how researchers working in the cognitive tradition assert that each emotion is the outcome of a unique appraisal (e.g. Arnold, 1960; Lazarus, 1991). Although each stimulus can

**Table 1-3 Appraisals distinguishing emotions.**

Appraisal	Emotion
(Pleased about) the prospect of a desirable event	Hope
(Pleased about) a desirable event	Joy
(Approving of) one's own praiseworthy action	Pride
(Pleased about) the confirmation of the prospect of a desirable event	Satisfaction
(Displeased about) the prospect of an undesirable event	Fear
(Displeased about) an event presumed to be desirable for someone else	Resentment

Source: Ortony et al. (1998)

elicit a range of emotions, each appraisal type results in a specific emotion. Several researchers developed models of emotion that distinguish between emotions on the basis of appraisals. Table 1-3 displays some examples drawn from a well-accepted appraisal model developed by Ortony et al. (1988).

The major advantage of this and similar models is that they not only distinguish between emotions, they also explain how emotions are elicited (i.e. 'the process of emotions'). These models are therefore also useful to explain how *products* elicit emotions. Given this advantage, in part C of this thesis these models are used to develop a 'model of product emotions.'

Like the researchers working with the first approach, those working with the second approach focus on *distinct* emotions. Generally, their models include the basic emotions (see Table 1-2) to which some others are added. Examples of emotions that are included in most models are *pride*, *relief*, *hope*, *love* (e.g. Lazarus, 1991; Roseman, 2001; Smith & Ellsworth, 1987; Scherer, 2001; Ortony et al., 1988). Other emotions are included only occasionally, such as *disappointment* and *satisfaction* (Ortony et al., 1988), *jealousy* (Lazarus, 1991), *challenge* (Smith & Ellsworth, 1987), and *boredom* (Scherer, 2001; Smith & Ellsworth, 1987).

A disadvantage of the appraisal models is that, because each model focuses on partly different emotions, it is difficult to compare the appraisal characteristics proposed by the various researchers.

### **(3) Differentiating emotions on the basis of their underlying dimensions**

The major claim of those following the dimensional approach is that emotions are best described and differentiated by the use of underlying dimensions. This claim entails that emotions are interrelated, and thus that some emotions are more similar (e.g. *anger* versus *irritation*) than others (e.g. *boredom* versus *inspiration*). Underlying dimensions have been found in numerous studies, including studies on emotion words (e.g. Averill, 1975), facial expressions (e.g. Gladstones, 1962), and self-reported emotions (e.g. Mehrabian & Russell, 1977).

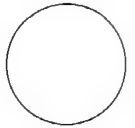
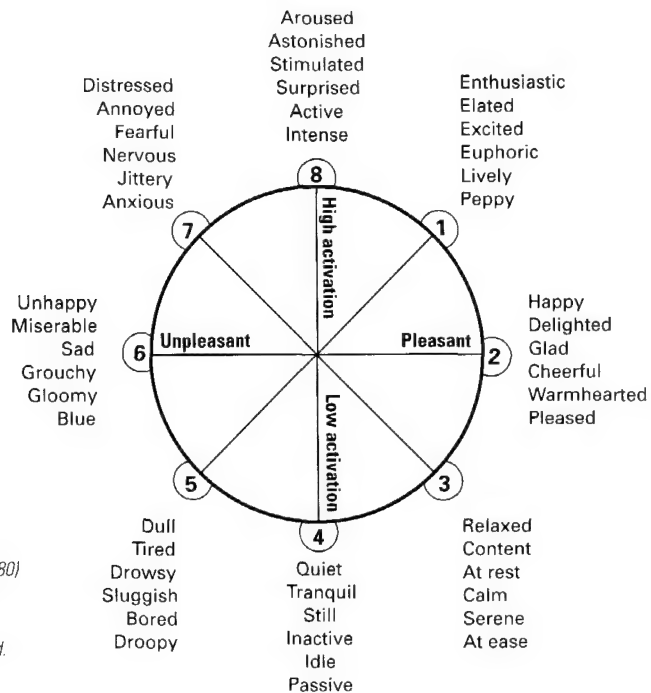


Figure 1-2 The Circumplex of Emotions.



Source: Adapted from Russell (1980) and Watson and Tellegen (1985). The numbers represent octants in which the Circumplex was divided. For each octant, some emotions are represented.

Although there is discussion on how many dimensions are necessary to describe the variation in emotions, some consensus has been reached over the years. That is, in most of the studies *two* dimensions are reported to account for the major amount of variance in emotions (see Wundt, 1905). These dimensions are generally labelled as 'pleasantness' and 'activation.' The bipolar dimension 'pleasantness' ranges from unpleasant (e.g. *unhappy*) to pleasant (e.g. *happy*). The dimension activation is defined as physiological arousal (Clore, 1994), and ranges from calm (e.g. *content*) to excited (e.g. *euphoric*).

Emotion dimensions are sometimes visualised in, for example, a conical figure (Daly, Polivy, & Lancee, 1983), or a cross figure (Watson & Tellegen, 1985). An often-applied figure was created by Russell (1980): 'the Circumplex of Emotions' (Figure 1-2). The two orthogonal axes in the Circumplex represent the dimension 'pleasantness' (horizontal), and 'activation' (vertical). Figure 1-2 illustrates that, with the two dimensions, emotions can be classified in eight octants. The figure shows some classification examples (e.g. *enthusiasm* is 'activated-pleasant' (Octant 1); *boredom* is 'calm-unpleasant' (Octant 5)).



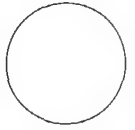
The major criticism of the dimensional approach is that, although it can categorise emotions, dimensions are not *sufficient* to differentiate between emotions. For example, the emotions *anger* and *fear* fall close together on the Circumplex. Clearly, these are different emotions, even though they are positioned at the same location. Apparently, their differences are not captured with the two dimensions. Nevertheless, the dimensional approach also has some important advantages. The first is the comprehensible way in which emotions are structured. Second, the models of emotions that are based on the dimensional approach include not only high-activation emotions, but also low-activation emotions such as *boredom* and *satisfaction*. For this reason, in this thesis, the Circumplex has been used to classify emotions (see Study 1 in Section 2.2).

As discussed above, each of the three approaches to differentiating between emotions has its particular advantages and disadvantages. As a result, it was decided not to select one of these approaches for the current research. Instead, for different aims, different approaches were used. In Chapter 2, the *third* approach was used to classify emotions. Subsequently, in part B of this thesis, the *first* approach was used in the development of an instrument to measure product emotions. In Part C, the *second* approach was used for the development of a 'model of product emotions' that explains how products elicit emotions.

## 1.5 Product emotions

The question posed in the introduction to this chapter was whether or not product emotions are 'real' emotions. In other words, are the emotions we experience towards products the same emotions as those that we experience towards important events in our lives. To answer this question, current perspectives in psychology have been reviewed in search of a description or definition of what emotions are. Based on an analysis of some of the prevailing debates in this field, emotions have been (a) distinguished from other affective states, (b) defined, and (c) distinguished from each other.

The question of whether or not product emotions are real emotions is similar to the question that underlies discussions in the field of 'aesthetic emotions' (i.e. emotions elicited by works of art, (see Frijda & Schram, 1995)). Many researchers who study aesthetic emotions consider emotional responses to art to be as genuine as emotions experienced in our daily lives. Lazarus (1991), for instance, concluded in his cognitive theory of emotions, that aesthetic emotions do not require special concepts, and that they can be explained with the same appraisal principles as 'real' emotions. The same applies to product emotions. On the basis of the review reported in this chapter, it is concluded that product emotions do not represent a



special type of emotions, and that they have the same qualities as the emotions we experience towards people and events.

In Section 1.2 we saw that emotions always involve a relationship with a particular object (which can be an artefact or a person). It was discussed that, in the case of product emotions, the object of emotion is not always the product itself. In some cases the object is some association or fantasy that is induced by the product. This distinction corresponds with the distinction made by Tan (2000) regarding 'aesthetic emotions.' With respect to the objects of emotion, he distinguished between two types of aesthetic emotions. First, A-emotions are emotions related to the material artefact. One can, for instance, be *fascinated* by the lines and colours of a painting, or *admire* the artist who created the work of art. Second, R-emotions are emotions related to representations of something besides the artefact itself. An example is the emotional response one may experience to the person who is represented on a figurative painting. Non-figurative works of art may also represent things besides the artefact itself (e.g. memories or imaginary landscapes evoked by a piece of music). Whereas A-emotions have 'real' objects, such as the object of art itself or the artist who made the object, the objects of R-emotions are imaginative, existing only in a fictitious word.

Obviously, products can also elicit A-emotions. One can, for example, *admire* the designer who created an innovative new bicycle concept, or be *fascinated* by the softness of the material of a chair. Products also elicit R-emotions. In the case of products, the object of these R-emotions are the fantasies we have about what a product means or may mean to us. These fantasies can be both anticipatory and retrospective. For instance, a person may feel *desire* towards a new abdominal workout device because they anticipate that with this device the perfect body is within their reach. Or, someone may be *inspired* by the sight of a backpack because it reminds them of an exciting hiking expedition.

It is important to understand the various objects of product emotions, because the object-focus is one of the key-variables that constitute the emotion's eliciting conditions. Therefore, the objects of product emotions are thoroughly examined in part C of this thesis.

Although it has been concluded that product emotions are not a special type of emotions, there remains the question of whether or not products can elicit the full repertoire of emotions. Can product appearance (which is a specified stimulus type) elicit any possible emotion, or are the responses limited to a particular 'subset' of emotions? In reviewing the research literature, it became apparent that most psychologists who study human emotions are generally more interested in (the process of) emotions 'as such' than in the nature of emotional stimuli. In the words of Scherer



(1988, p. 89): "[...] one is struck by the remarkable lack of concern with the antecedent or eliciting conditions for emotional reactions." As a consequence, on the basis of the research literature, it cannot be concluded whether some emotions are more relevant than others for the study of product emotions. In Chapter 2, therefore, a series of studies is reported that are aimed at finding which emotions are most relevant for the study of product emotions.

## Notes

- [1] Acknowledging important contributions to the understanding of the concept of emotion in anthropology, biology, philosophy and sociology, the current review is focused on the major debates on the nature of emotions in psychology. For the current purposes, the field of psychology is seen as the most relevant because it is concerned with the role of the *person-object* relationship in emotions (generally, biology focuses on the person and philosophy on the emotion. Anthropology and sociology focus on the cultural and social conditions rather than on the individual experience).
- [2] It is not suggested that the traditions of research on emotion discussed in this section are the only three. Other reviewers sometimes distinguish other (or more) traditions. Cornelius (1996), for example, proposes a 'social constructivist perspective' as a fourth tradition in emotion research. Another important (and relatively new) tradition is the neurological tradition (see LeDoux, 1989), which draws on work in neurophysiology and neuroanatomy. It was decided to discuss the selected three traditions because these provide non-expert readers with the overview that is both necessary and adequate to understand the issues discussed in this thesis.
- [3] The autonomic nervous system (ANS) is the part of the nervous system that carries impulses from the brain to the various internal organs, such as the heart and stomach. It is responsible, among other things, for controlling sweating, secreting digestive juices, and shedding tears. The ANS constantly adjusts the activity level of our 'life support systems' in response to the demands of our environment. In general, the ANS directs activities that prepare the body for vigorous activity (see Gazzaniga, 1995). For example, in a situation in which you are suddenly startled by a loud noise, it is the ANS that causes your heart to begin beating faster.
- [4] The distinction between cognition and emotion, and the place of cognition in the process of emotion, has been the subject of extensive debate (often referred to as the 'cognition – emotion debate', see Zajonc 1980, 1984; Scherer, 1982, 1999). Eventually, Leventhal and Scherer (1987) characterised this debate as a purely semantic controversy. Cognition, like emotion, is difficult to define because it is a broad concept that encompasses several contrasting types or levels of processes: automatic versus deliberate, conscious versus unconscious. Those opposed to the cognitive perspective of emotions seem to regard cognition as rational and conscious, whereas the cognitive emotion theorists hold that cognitive appraisal may be rapid and unconscious (in the words of Arnold (1960, p. 170), appraisal is a "direct, non-reflective, non-intellectual automatic judgement of the meaning of a situation").
- [5] Although, since Arnold, numerous alternative definitions have been proposed (see Kleinginna & Kleinginna, 1981), these definitions are generally specifications or modifications of Arnold's definition. At this time, the essence of the various definitions, proposed by researchers who work with the cognitive perspective, is still adequately captured by the definition proposed by Arnold.



## 2: Product emotions



### 2.1 Introduction

Humans are capable of distinguishing many distinct emotions. This ability is illustrated by the vast number of emotion-denoting words that exist in most human languages. In the English language researchers have reported lists of 200 to 300 words that are used to cover the full range of emotions (see Davitz, 1969). Can all of these emotions be elicited by the appearance of a product? In Chapter 1 we saw that the research literature offers no answer to this question, because emotions elicited specifically by product appearance have not yet been studied. As a consequence, the lists of emotions reported in the literature may not represent emotions that are generally elicited by product appearance.

Which then are the emotions that are usually generated by product appearance? Although we may experience each possible emotion in relation to a product's appearance, some are probably experienced more frequently than others. For example, it is easier to imagine someone being *bored* by a product's appearance than someone being *frightened* by a product's appearance. Undoubtedly, some creative thinking would supply examples of product appearances that elicit fear (e.g. "a dangerous looking chain-saw"). Nevertheless, in daily life the emotion of fear probably does not occur as often as boredom. Following this line of reasoning, some emotions can be regarded as being more relevant than others to the current research.

The objective of this chapter is to generate a manageable set of *product relevant emotions*, i.e. emotions likely to be elicited (or often elicited) by product appearance. This objective had two motivations. First, in Part B of this thesis, an instrument is developed that measures the distinct emotions that are elicited by product appearance. To ensure content validity, this instrument should measure only emotions that are product relevant. Second, in Part C, the appraisals that elicit product emotions are investigated and this investigation too should be focussed only on relevant emotions.

In Chapter 1, we saw that sets of emotions reported in the research literature often over-represent unpleasant emotions. The emotions included in the reported sets of basic emotions predominantly classify in Octant 6 (i.e. average-unpleasant) of the Circumplex of Emotions (see Figure 1-2 in Chapter 1). This is because the focus of this reported research is on universal 'evolutionary' emotions. The focus of the current research, however, is on the emotions often elicited by product appearance, and there is no reason to presume that these emotions are also concentrated in Octant 6, or in any particular octant. Moreover, in an early study it was found that a set of mobile telephones elicited emotions from each octant (Desmet, Overbeeke, &



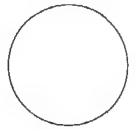
Tax, 2001). In the current research, it was therefore decided to develop a set of product relevant emotions in which all octants are represented. For this development, a multistage method was used that is similar to methods used in earlier studies in psychology (i.e. Davitz, 1969), and in advertising research (i.e. Aaker, Stayman, & Vezina, 1988). The starting point of this method was an extensive set of emotions that was reduced to a manageable set in a series of successive steps. The next three sections each present a step that was taken to reduce a set of 274 emotions to a set of 41 product relevant emotions (see Figure 2-1).

In Study 1 (Section 2.2), 347 emotions were classified with the use of the two underlying emotional dimensions of the Circumplex of Emotions. In addition, 65 emotions were omitted because they were unfamiliar or ambiguous. In Study 2 (Section 2.3), from this classified set, emotions were omitted that are rarely elicited by product appearance. The result was a set of 69 product relevant emotions. Subsequently, in Study 3 (Section 2.4) this set was further shortened by eliminating those emotions that are approximately similar to others in the set. Finally, in Section 2.5, the final set of 41 product relevant emotions is discussed in relation to basic emotions that have been reported in Section 1.4.

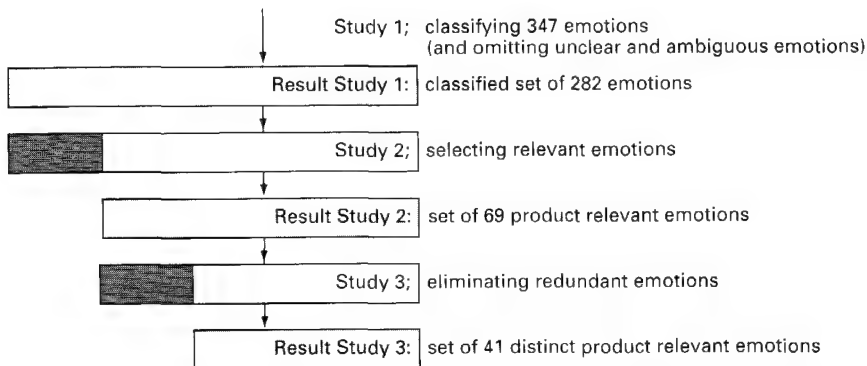
## 2.2 Classifying emotions – Study 1

The first step in the development of a set of product relevant emotions was to assemble a set of emotions that is sufficiently extensive to represent a general overview of the full repertoire of human emotions. Subsequently, in Study 1 each emotion of this assembled set was classified in one of the Circumplex octants. In addition, the results of Study 1 were used to detect and omit emotion words that were either unfamiliar or ambiguous. The study resulted in a set of 282 emotions classified in eight categories.

A complication that occurs when assembling a set of emotion words is that not everyone is familiar with all of the words. Thus, for reasons of comprehensibility, the set of product relevant emotions should not include such unfamiliar emotions. In addition, Frijda (1970) found that some emotion words are *ambiguous*. The interpretation of ambiguous emotion words requires (and depends on) a situational reference. The meaning of these words is largely determined by the context of the sentence. The word *affected* is an example of an ambiguous emotion word. For instance, we might say "I was affected by his grief when he failed in the examination" or "I was affected by her brilliant performance." Although in both examples the word *affected* has been used, in the first example it refers to an unpleasant emotion and in the second to one that is pleasant. As the words in the set of product relevant emotions will not be used in the context of a sentence, the set should not include



**Figure 2-1 Three steps in developing a set of product relevant emotions.**



ambiguous words. The results of Study 1 were therefore used to identify and eliminate both unfamiliar and ambiguous emotion words. This was done on the basis of the assumption that emotion words that are familiar and unambiguous should show a high inter-participant agreement when categorised in the octants of the Circumplex of Emotions (see Figure 1-2 in Chapter 1).

## Method

### Participants

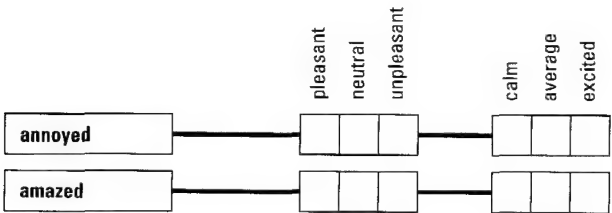
The participants ( $N = 20$ ; ten female, ten male) were undergraduate students ( $n = 12$ ) and staff members ( $n = 8$ ) from Delft University of Technology. All participants were of Dutch nationality, with Dutch as their mother tongue. The undergraduate participants were paid for their contribution.

### Material

A set of 347 emotion words was compiled by merging and translating three reported lists of emotions (i.e. Davitz, 1969; Frijda, 1970; Fehr & Russell, 1984). The English emotion words were translated into Dutch using van Dale's *English to Dutch dictionary* (i.e. Martin & Tops, 1986).<sup>1</sup> The words have been declined to fit into two sentences: "This product makes me feel ...," and "Because of this product I am ...". The words were printed in a booklet of ten pages (each page displaying approximately 30 emotions). Twenty versions of this booklet were printed, each with the emotions printed in a random order. The emotions were printed on the left side of the pages. On the right side, two three-point rating scales for the dimensions 'pleasantness' and 'activation' were presented (see Figure 2-2). In ten of the booklets the 'activation' scale was printed to the left of the 'pleasantness' scale and in the other ten the 'pleasantness' scale was printed to the left of the 'activation' scale.



Figure 2-2 Rating scale used in Study 1.



### Procedure

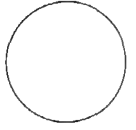
In a written introduction the participants were instructed to rate each emotion word on the two rating scales and told that they were not allowed to rate an emotion as both 'neutral' (on the dimension of pleasantness) and 'average activated', because this would mark the centre of the Circumplex. In addition, the participants were instructed to mark emotion words with which they were not familiar. After reading the introduction, each participant performed the task individually at his or her own pace. All participants finished the task in about an hour.

The stimuli were divided over two separate sessions. In the first session, participants rated the emotions on the first five pages of the booklet. The second session, in which the emotions on the five remaining pages were rated, took place approximately one week after the first. The task was split up into two sub-tasks, because participants were not able to maintain concentration for more than approximately 200 emoting words.

### Results & Discussion

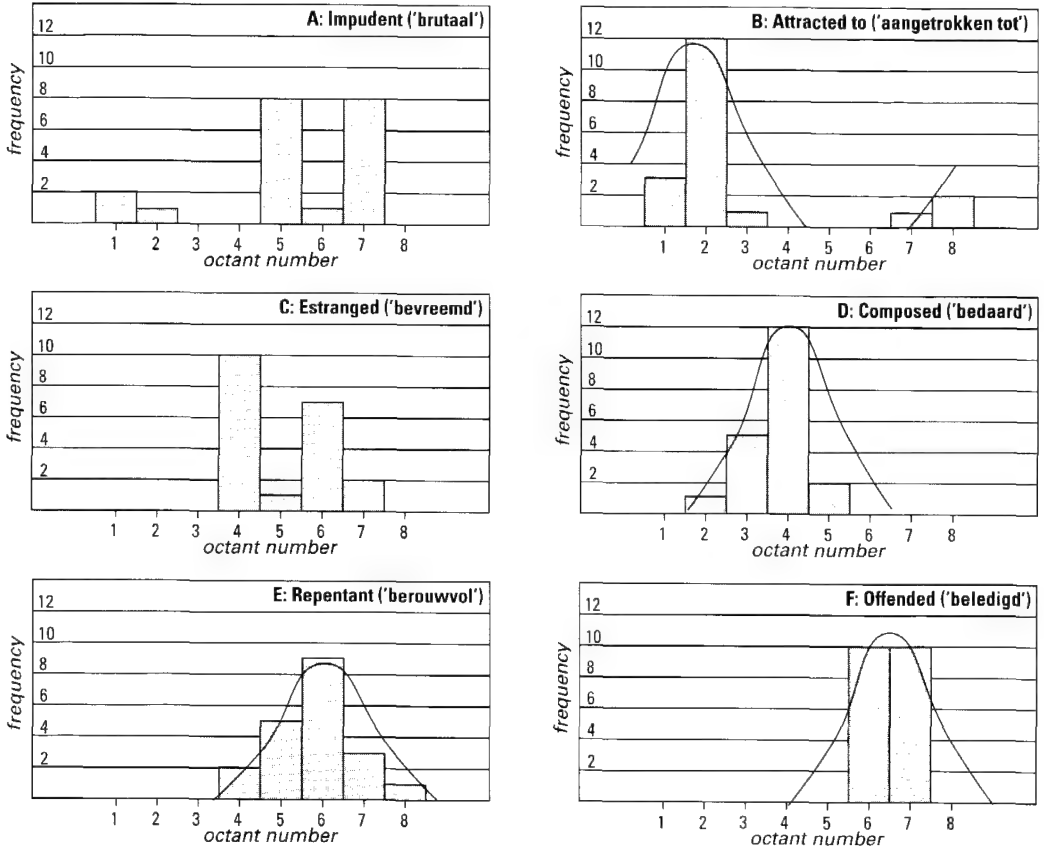
For each person and each emotion word an octant number was derived by combining the ratings on the two scales (e.g. a 'pleasant' and 'excited' rating is represented by Octant 1; see Figure 1-1). Frequency distributions for each emotion word indicate how often a word was assigned to a particular octant. By way of example, Figure 2-3 (a-f) contains graphic representations of the results for six emotion words.

Russell (1980, p. 1165) proposed that an emotion word is best considered "a label for a fuzzy set, defined as a class without sharp boundaries." As a consequence, the place of an emotion word on the Circumplex is not sharply defined but rather covers a small area of the circle. The graphic representations of the results exhibited this 'fuzziness' of emotion words. Most of the 347 graphs resembled the graph of a normal distribution (e.g. Figure 2-3 -d and -e). The frequency distributions of some emotion words did not follow a normal distribution, but showed substantial disagreement between participants (e.g. Figure 2-3 -a and -c). This inter-participant disagreement indicated that either the particular emotion word was ambiguous or that



**Figure 2-3 Examples of frequency distributions.**

The graphs indicate how often each of six emotion words was assigned to a particular Circumplex octant ( $N = 20$ ).  
Note that the test was performed in Dutch (the original Dutch words are placed between brackets).



not all participants were familiar with the word. Either way, both ambiguous and unfamiliar words should be excluded.

Ambiguous and unfamiliar words were distinguished from those that were both clear and unambiguous by the use of a numeric criterion. This criterion was defined on the basis of the assumption that an emotion word that is clear and unambiguous is indicated by an octant frequency that is significantly higher than chance level (because the distribution resembles a Normal distribution). A word was therefore accepted if the highest octant frequency was at least 12 ( $p < .05$ ; binominal distribution). Note that on the basis of this criterion some emotions may be wrongfully omitted. These are words that are evenly distributed over two adjoining octants (see



**Table 2-1 Octant distributions of 282 emotion words.**

Octant	Amount of included emotions	Octant	Amount of included emotions
1; excited pleasant	30	5; calm unpleasant	34
2; average pleasant	53	6; average unpleasant	61
3; calm pleasant	24	7; excited unpleasant	46
4; calm neutral	14	8; excited neutral	20

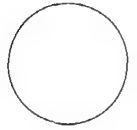
Figure 2-4; ‘offended’). Because these emotion words are not ambiguous, the criterion was supplemented with a second criterion: A word was accepted if the frequencies of two adjoining octants were both at least 8 ( $p < .05$ ; binominal distribution).

On the basis of the two criteria, 49 ambiguous words were identified and omitted from the set. In addition, 16 emotions were omitted because two or more participants marked them as unfamiliar. The remaining 282 emotion words were categorised in the octant with the highest frequency (see Appendix 1-1). Table 2-1 shows the distribution of the 282 emotion words over the Circumplex octants.

## 2.3 Selecting relevant emotions – Study 2

In Study 1, an extensive set of emotions was assembled and classified. This set not only includes emotions that seem to be regularly elicited by product appearance (e.g. desire and boredom), but also emotions that seem less relevant (e.g. rage and euphoria). In order to further reduce the set of 282 emotions, Study 2 was designed to select within each octant the emotions that are most often elicited by product appearance. On examining the words in the resulting set, it was found that some words do not refer to emotions but to other types of affective states (for a discussion of affective states, see Section 1-1). As the current research focuses specifically on emotions, words that refer to other states have been omitted from the set.

In the assessment of ‘product relevancy,’ participants were asked to select the emotions they experienced in response to product appearance. For this assessment, various methods can be used, each with particular advantages and disadvantages. The assessment can be based on (a) recollections, (b) responses to stimuli, or (c) a diary. In the first approach, participants rate the emotions on the basis of their recollection of emotions elicited by product appearance in their daily lives. The main advantage is that the reports are independent of particular stimuli. The disadvantage is that reports based on memory may be distorted, because participants may not accurately remember their responses. In the second approach, participants rate the emotions in response to a set of stimulus products. The main advantage is that the assessment is based on real responses and therefore circumvents memory problems. The main disadvantage is that the results depend on the set of used stimuli. In order



to represent a general overview of product appearance, a large number of stimulus products should be used. This approach is not practical, because for each stimulus product 282 must be rated. In the third approach, participants keep a diary in which they report the emotions they experience over a period of time (e.g. four weeks). The advantage is that the results represent real responses instead of those elicited by a particular set of stimuli or remembered responses. Like the second approach, the disadvantage is that it is impractical to rate 282 emotions each time a product elicits an emotional response(s).

On the basis of the issue of practicality, the first approach was used for the assessment. The memory of each participant was stimulated with the use of collages that depicted examples of products. To avoid participants responding to the particular product examples, instead of using their recollection for their reports, the collages were created to provide a broad overview of products. Moreover, participants were not given the opportunity to fixate on the example products, because the collages were shown for only a *short* period of time *before* they performed the rating task.

## Method

### Participants

The participants ( $N = 22$ ; 11 males, 11 females, aged between 23 and 50) were members of the consumer panel of the Department of Industrial Design Engineering at Delft University of Technology. This panel is an *a-select* sample of people living in Delft and the surrounding area (see Tan, 1995a). None of the participants were professional designers or involved in the field of product design. None of them had participated in Study 1.

### Material

The set of 282 emotions assembled in Study 1 was printed in an eight page booklet. On each page the emotions of one octant were printed in randomised order. To stimulate the participants' memory, six collages were created that depicted a broad overview of consumer products. Each collage represented consumer products from one of the following themes: work, sports, household, travel, hobby, and personal care.

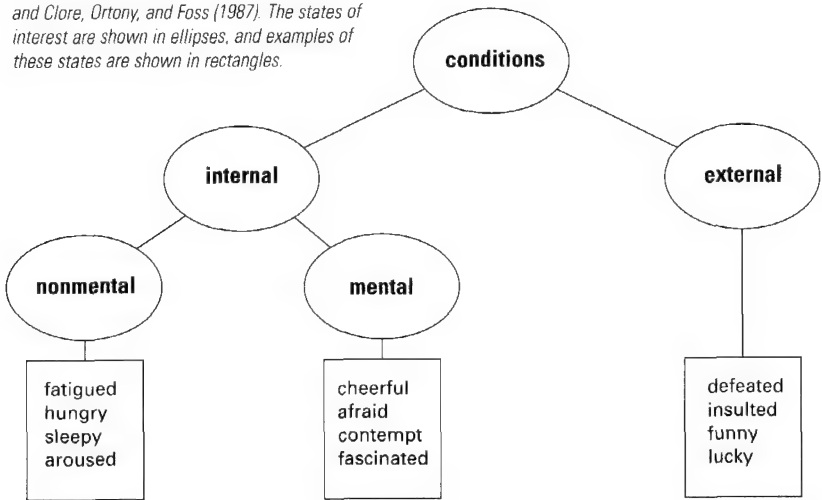
### Procedure

The task was explained in a formal introduction. Participants were told that the emotions on each page were similar in terms of pleasantness and activation level. It was explained that the study involved emotions that they would remember having experienced in response to product appearance. It was stressed that they should consider only emotions evoked by seeing, touching, tasting, smelling or hearing a product, not those evoked by buying, owning or using the product. For each octant, participants were instructed to select a 'top five' of emotions, and to rank these five



**Figure 2-4 Structure of affective words.**

Source: Adapted from Ortony, Clore, and Foss (1987), and Clore, Ortony, and Foss (1987). The states of interest are shown in ellipses, and examples of these states are shown in rectangles.



emotions in order of relevance. The most often experienced emotion was given five points, the second most often four, and so on.

In addition, the purpose of the collages was explained. It was stressed that the collages were shown *only* to trigger the memory, and that this study did not concern the emotions evoked by the collages. After the introduction, participants had two minutes to look at the collages. They were then instructed to fill out the form at their own pace, and to take a break if necessary. The task was performed individually.

## Results

The selection of product relevant emotions was based on the emotion word sum scores. The total sum of ratings over participants and octants were determined. These sum scores are presented in Appendix 1-2. It was decided to remove all emotion words that did not fall within the '80% boundary.' The total number of points given to emotion words in each octant was 330 (22 participants x 15 points per participant). The 80% boundary represents the emotions with the highest sum-scores, which add up to 264 points (i.e. 80% of 330 points). For example, in Octant 1 (pleasant-excited), the 80% boundary is between *jubilant* ('uitbundig'; sum score = 13 points) and *powerful* ('krachtig'; sum score = 9 points). Using this criterion, the set was reduced to 90 emotions. These are underlined in Appendix 1-2. Appendix 1-3 gives an overview of the Dutch – English translations of these 90 emotions.



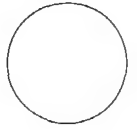
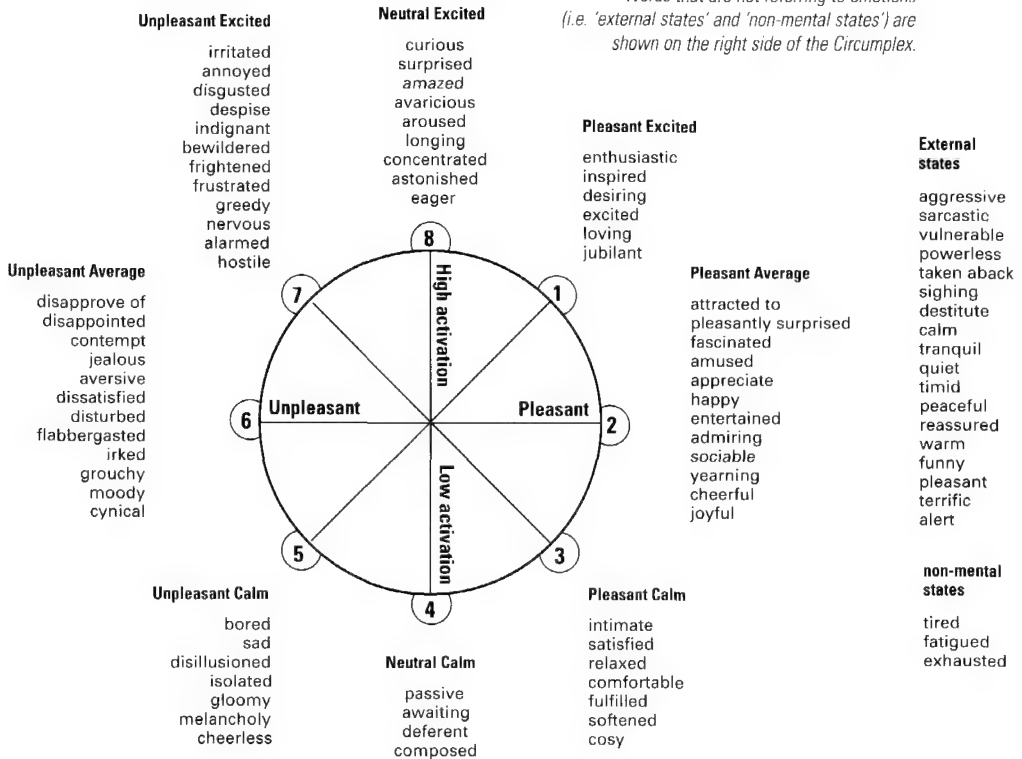


Figure 2-5 Circumplex of 69 product relevant emotions.

In the figure, 69 product relevant emotions are classified in octants of the Circumplex of Emotions.

Words that are not referring to emotions (i.e. 'external states' and 'non-mental states') are shown on the right side of the Circumplex.



## Discussion

Ortony, Clore, and Foss (1987) asserted that some of the words usually used in studies of emotions do not refer to emotions but to other affective or non-affective states. Also an examination of the words included in the set of 90 product relevant emotions raised the question of whether or not they are all real emotions. For instance, it is questionable whether or not the state of 'feeling tired' is an *emotion*. It was therefore decided to further reduce the set. On the basis of a hierarchical structure of the affective lexicon developed by Ortony et al. (1987; see Figure 2-4), words that do not refer to emotions but to other states were eliminated from the set of product relevant emotions.<sup>2</sup>

On the top level of the structure, words referring to 'internal states' are distinguished from those referring to 'external states.' External states (e.g. sexy and



*abandoned*) are eliminated because they are not directly related to the 'inner life' of the person on whom they are predicated. On the next level in the structure, internal states are distinguished as either 'mental' or 'non-mental.' Non-mental states (e.g. *sleepy* and *hungry*) are eliminated because they do not refer to emotions but to physical and bodily states. In short, according to this structure only words that refer to internal mental states are accepted as emotions.<sup>3</sup> Following this structure, some words of the set of product relevant emotions can be identified as referring to either external states or internal, non-mental states. These words are eliminated from the set of product relevant emotions. In Figure 2-5, the words have been coded on the basis of the empirical findings of Clore et al. (1987).

In this figure, 21 words that do not refer to emotions have been indicated. *Peaceful*, for example, refers to an external state, and *fatigued* refers to a non-mental state. Following this procedure, the set of product relevant emotions was reduced to 69 emotions.

## 2.4 Eliminating duplicate emotions – Study 3

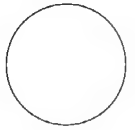
Study 2 resulted in a set of 69 categorised product relevant emotions. Although each of these emotions can be elicited by product appearance, it is unclear to what extent they all represent unique emotions. Some of them differ more from each other (e.g. *amazed* and *bored*) than others (e.g. *amazed* versus *astonished*). Some emotions within octants seem to be very similar, such as *irritated* and *annoyed* in Octant 7, and *sad* and *gloomy* in Octant 5. In Study 3 the set of product relevant emotions was fine-tuned by identifying and eliminating duplicate emotions.

Although emotions within octants are similar in terms of pleasantness and activation, they can differ in terms of expression, behaviour, feeling, and underlying appraisal. In the following, the overall differences between emotions will be referred to as differences in their 'nature.' A suitable statistical technique to assess the differences in the nature of emotions is a hierarchical cluster analysis. This has been successfully used to develop emotion classifications in, for example, consumer research (see e.g. Batra & Holbrook, 1990). With this analysis, emotions have been grouped into similarity clusters, so that emotions in the same cluster are more alike than emotions between clusters.

### Method

#### Participants

The participants ( $N = 40$ ; 20 males, 20 females) were undergraduate students ( $n = 37$ ) and staff members ( $n = 3$ ) from Delft University of Technology. None of them had participated in Study 1 or 2. The undergraduates were paid for their contribution.

**Table 2-2 Emotion pairs.**

Set	Octant combination	Pairs
1	Octant 1 and 2	267
2	Octant 2 and 3	171
3	Octant 3 and 4	55
4	Octant 4 and 5	55
5	Octant 5 and 6	171
6	Octant 6 and 7	153
7	Octant 7 and 8	105
8	Octant 8 and 1	210
	TOTAL	1187

### Material

Cluster analysis requires inter-object similarity ratings. In this study, these similarity ratings were obtained by rating the emotions in pairs. Not all the possible pairs of emotion words were composed, because emotions in non-neighbouring octants are not likely to have a similar nature. Therefore, pairs were only composed of emotions within octants and adjoining octants (see Table 2-2).

The total set of emotion pairs included 1187 pairs. Of this set, ten randomised versions were prepared, and each version was divided into four subsets (i.e. three sets of 297 pairs and one set of 296 pairs).

### Procedure

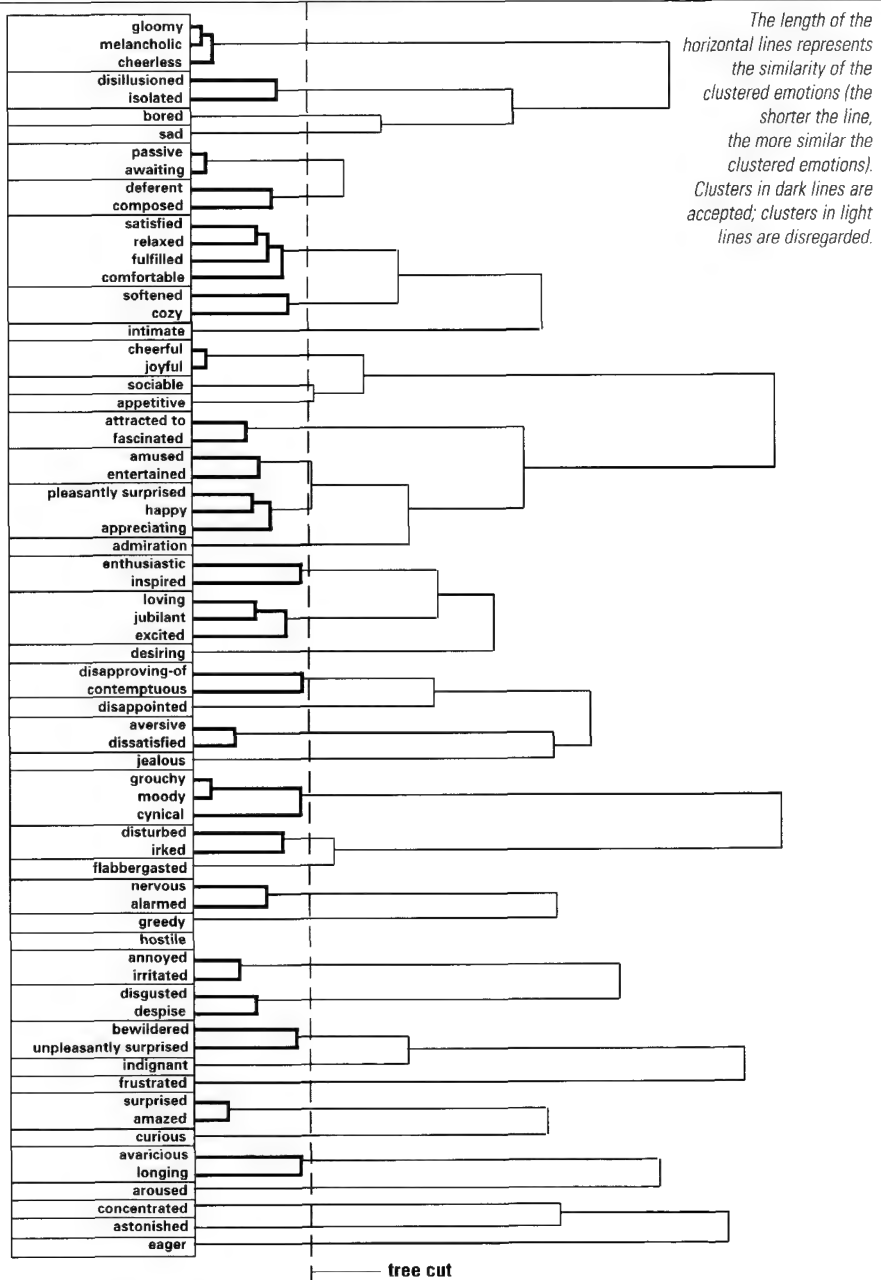
Each participant was instructed to rate the pairs of one subset on a four-point scale, ranging from 'similar' to 'not similar.' The task was performed individually using a computer. The computer procedure started with an introduction in which the task was explained. Participants were instructed to rate the pairs at their own pace, and after rating 150 pairs the computer announced a 15-minute coffee break.

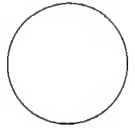
## Results & Discussion

Mean similarity scores of all emotion pairs were computed. On these mean scores, a hierarchical cluster analysis was performed.<sup>4</sup> This analysis produces a dendrogram (Figure 2-6), which is a graphic representation of the cluster steps. The length of the tree branches in the dendrogram represents the similarity of the emotions. For example, the dendrogram shows that of all 69 emotions, *gloomy* and *melancholic* were the most similar, followed by *cheerful* and *joyful*. On the basis of the dendrogram one can select either many clusters that each include a few emotions, or a few clusters that each include many emotions. The obvious question is where to cut the tree so that the optimal number of clusters is found. Because no standard or



Figure 2-6 Cluster dendrogram of 69 emotion words.





objective selection procedure exists, heuristic procedures are by far the most commonly used methods (Aldenderfer & Blashfield, 1989).<sup>5</sup> In this analysis the tree was cut at the 29th clustering step. This decision was based on a theoretical consideration. In this step, the emotions *amused* and *pleasantly surprised* are clustered. As these two emotions have been recognized to have a different nature (see Fredrickson & Branigan, 2001; Frijda, 1986), this cluster can be regarded as one that clusters non-similar emotions. Consequently, clusters made in the first 28 steps were accepted, whereas those made in the following clustering steps (i.e. steps 29 to 68), were disregarded.

The result is that the set of 69 was reduced to a set of 41 product relevant emotions. Of each cluster, the emotion with the highest sum-score in Study 2 was selected to represent the cluster (see Figure 2-7).

## 2.5 Product emotions

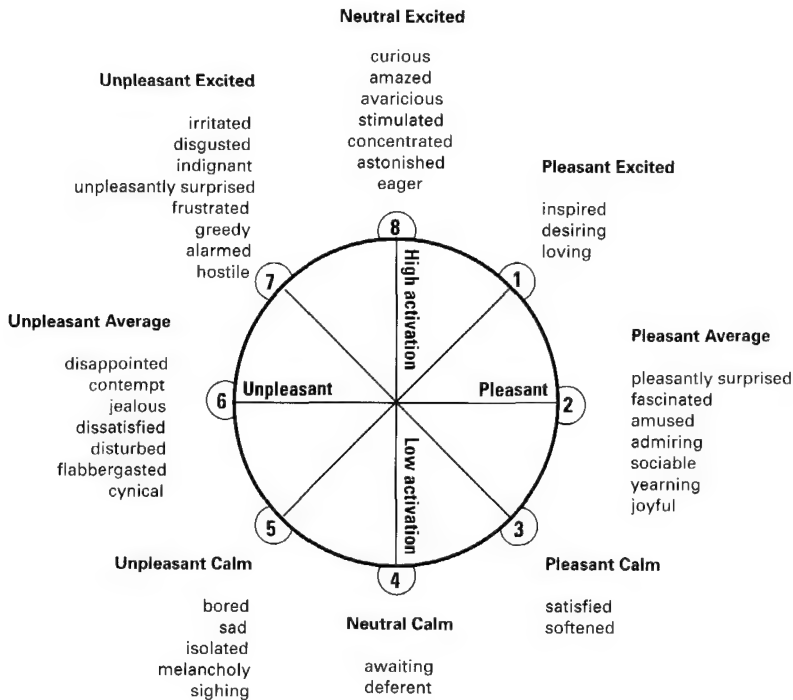
The main reason for developing a set of product relevant emotions, rather than using the existing emotion sets, was twofold: (1) the basic emotion sets over-represent unpleasant emotions, and (2) these sets do not cover some emotions that seem to be relevant to product appearance, such as *boredom* and *inspiration*. The set of product relevant emotions overcomes both shortcomings; the number of pleasant and unpleasant emotions is balanced, and the set includes emotions that are more subtle than the basic or prototypical ones (e.g. *admiring*, *satisfied*, and *softened*).

At first sight, there seems to be little agreement between the basic emotions and the product relevant emotions. Only three emotions can be found in both sets: *joy*, *contempt* and *disgust*. However, if we examine the emotions on a more general level greater agreement can be observed.<sup>6</sup> Then, in fact, only three basic emotions *cannot* be found in the set of product relevant emotions: *shame*, *guilt* and *fear*. The explanation for this lies with the appraisals that precede these emotions. The emotions *shame* and *guilt* require an appraisal of the blameworthiness of one's own actions (Lazarus, 1991; Ortony et al., 1988). Obviously, self-blame is not likely to be relevant for the appearance of a product. A similar explanation applies to the emotion *fear*. This emotion is preceded by an appraisal of physical danger (Plutchik, 1980). Apparently, in our 'modern' society products are designed in such a way that we seldom appraise them as a physical threat. As a consequence, this emotion is not represented in the set of product relevant emotions.

Derivatives of all other basic emotions (i.e. *anticipation*, *interest*, *surprise*, *sadness* and *anger*) can be found in the set of product relevant emotions. Interest is comparable to *curiosity* and *fascination*. Likewise, *anticipation* is comparable to *eagerness*

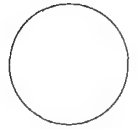


Figure 2-7 Circumplex of 41 product relevant emotions.



and *desire*. Lastly, *surprise* is represented in pleasant, neutral and unpleasant derivatives: *pleasantly surprised* (pleasant); *amazed* and *astonished* (neutral); and *frightened* and *alarmed* (unpleasant). Apparently, *surprise* and surprise-like emotions are often elicited by product appearance.

In addition to the emotions that are derivatives of the basic emotions, the set of product relevant emotions also includes some emotions that cannot be derived from the basic emotions. The relation between the emotions *bored*, *inspired*, *amused* and *admiring* and the basic emotions is 'far-fetched.' Typically, what these emotions have in common is that they require more cognitive processing than basic emotions (e.g. Frijda, 1986; Ortony et al., 1988). For instance, whereas *fear* requires a 'simple' appraisal of physical threat, *inspiration* requires a more complex or 'evolved' appraisal. This finding corresponds with the structure of the affective lexicon that was discussed in Section 2-3. In this structure Ortony et al. (1987) classified emotion words on the basis of their referential focus, i.e. affect-focal emotions, behaviour-focal emotions and cognitive-focal emotions. With 'focus', Ortony and his colleagues



indicated the aspect of the emotion the emotion word in question refers to. *Bored*, *inspired*, *amused* and *admiring* all fall into the category of cognitive-focal emotion words. In conclusion, a product's appearance often elicits emotions that are preceded by relatively complex (or evolved) appraisals. Note that (as opposed to the basic emotions) these 'evolved' emotions are typically restricted to human experience (see Lazarus, 1991).

It is important to stress that the set of product relevant emotions does not provide a complete overview of all the emotions that a product can possibly elicit. First, it includes only those emotions that are often elicited by a product's *appearance*. The set would have included (partly) other emotions if it had been developed for product usage (e.g. using a malfunctioning computer), or ownership (e.g. owning an expensive car). Our appraisals are partly determined by our relationship with the particular product. Therefore, different emotions will emerge in different person-product relationships. The emotion *shame*, for example, which is not included in the current set, may be relevant in the context of product ownership (e.g. Thomas is ashamed of his old-fashioned shoes). Furthermore, the set does not represent *all* the emotions that can be elicited by a product's appearance, but only those that are *often* elicited by a product's appearance.

The final set of 41 product relevant emotions will be used in the next two parts of this thesis. In part B, an instrument to measure these product relevant emotions is developed, validated, and applied. In part C, appraisals of these product relevant emotions are defined, integrated in a tool for designers, and applied in design workshops.



## Notes

- [1] In some cases, the dictionary offered more than one translation. In those cases, all alternatives that referred to emotions have been included. This approach was adopted because the aim of the current study was to develop a set that is as comprehensive as possible.
- [2] One might wonder why this examination was not done at an earlier stage in the development of the set of product relevant emotions. The reason is that it was only at this stage of the development that the structure of the affective lexicon developed by Ortony et al. (1987) was introduced into the research.
- [3] Ortony et al. (1987) also proposed a third level, in which they defined mental states as either 'affect-focal,' 'behaviour-focal,' or 'cognition-focal.' Based on these three features, they distinguished five mental states (i.e. 'affective states,' 'affective-behavioural states,' 'affective-cognitive states,' 'behavioural-cognitive states,' and 'cognitive states'). They postulated that only affective words of the first three states refer to emotions. Nevertheless, it was decided to include *all* the mental states because otherwise relevant emotions such as *fascinated*, *surprised* and *inspired* would be excluded. Note that other authors regard these words as emotions (e.g. Frijda, 1986).
- [4] A hierarchical cluster analysis is a method of clustering objects (e.g. emotion words) on the basis of similarity. Each emotion word starts out as a separate cluster (i.e. 69 clusters). In the first step the two emotion words that are the most similar are combined to build a new cluster. Similarly, at every subsequent step clusters are combined, until all emotion words are members of a single cluster (in every step, 'emotion word clusters' that are the most similar are combined to build a new aggregate cluster).
- [5] According to Hair, Anderson, Tatham and Black (1995), the distances between clusters and successive steps may serve as a useful guideline, and the analyst may choose to stop when this distance exceeds a specified value. This specified value can be decided on the basis of *priori* criteria, practical judgment, common sense, or theoretical foundations.
- [6] The relationships between the basic emotions and the product relevant emotions 'on a general level' have been based on the findings of Batra and Holbrook (1990), and Shaver et al. (1987). Holbrook and Batra extensively reviewed literature on emotion types. Based on their review of 26 sources they defined 29 emotion types, each type representing sets of distinct emotions. Shaver and his colleagues proposed a prototypical structure of 134 emotions divided over 25 emotion types. Both sources have been used because not all product relevant emotions were represented in either one of them.



## **Part B**

# Measuring Emotions



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# 3: The product emotion measurement instrument



## 3.1 Introduction

In 1667, in his description of the expression of fear, the painter le Brun wrote: "The eyebrow, which is lowered on one side and raised on the other, gives the impression that the raised part wants to attach itself to the brain to protect it from the evil the soul perceives." To most of us this description seems somewhat absurd. Indeed, there will not be many psychologists who share le Brun's views on the origin of the expression of fear. Nevertheless, at a more basic level, the explanation contains a proposition that *is* supported by many psychologists today. This is the conviction that each emotion is associated with a particular – and recognizable – expression. In other words, we can recognize how a person feels by looking at his or her emotional expression.

This assumption has been employed in the *Product Emotion Measurement instrument* (PrEmo), an instrument designed specifically to measure product emotions, i.e. emotions that are evoked by the appearance of a product. This instrument was developed because one of the aims of the research is to study relationships between products' appearance and the emotions they evoke.

Traditionally, attempts to measure emotions have been done in the field of psychology and sociology. In this research literature many types of instruments for measuring emotions are reported. More recently (i.e. in the last twenty years), acknowledging the important role of emotions in their field of research, consumer and marketing researchers have developed instruments which measure the emotions elicited by advertisements and consumer experiences. Even more recently (i.e. in the last ten years), and as a result of the rapid invasion of computers into our daily lives, computer science has also become a player in the field of measurement of emotions. Given the fact that many people now spend many hours a day interacting with a computer, researchers in this field proposed that computers should be less cold, and more human. In order to be able to respond to the user's emotion, the computer must be able to detect and interpret this emotion, and this requires non-interfering measurement instruments ('affective computing,' see Picard, 1997). In Section 3.2, the various existing instruments are reviewed and their advantages and disadvantages discussed, and reasons are given for the decision to develop a new instrument specifically for the measurement of 'product emotions.'

The development of PrEmo was an iterative design process. Over a period of five years, six versions of the instrument have been created. The creation of each version was followed by an evaluation of its strengths and weaknesses and on the basis of this evaluation, renewed starting points were defined. Following this trial-and-error approach, improvements were made to each new version to correct the flaws of the previous versions.



Note that the PrEmo design process was closely intertwined with the development of the other two pillars of this research (i.e. the model of product emotions and the inspirational tool). As a consequence, not all the requirements that needed to be met by PrEmo had been defined *before* the design process was started. Instead, some requirements emerged and crystallised *during* (and as a result of) the development of the first three PrEmo versions. These 'early' PrEmo versions were designed to meet the following two requirements:

- The instrument should be applicable in different cultures, i.e. language independent.
- The instrument should not require extensive equipment or technical expertise.

During the development stages of PrEmo-1 to 3, and on the basis of the conclusions drawn from evaluating these three versions, two further requirements were formulated:

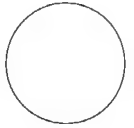
- The instrument should be able to measure specifically those emotions that are most often elicited by product appearance.
- Second, the instrument should be able to measure mixed emotions, i.e. when more than one emotion is experienced simultaneously.

PrEmo-4 to 6 were designed to meet all four requirements. In Section 3.3, the development of the early PrEmo versions is briefly reported. In Sections 3.5 and 3.6 two important features of the final PrEmo versions are discussed, i.e. the emotions that are measured and the animations that are used to measure these emotions. The final section, Section 3.4, presents the final version of the instrument: PrEmo-6.

## 3.2 Instruments to measure emotions

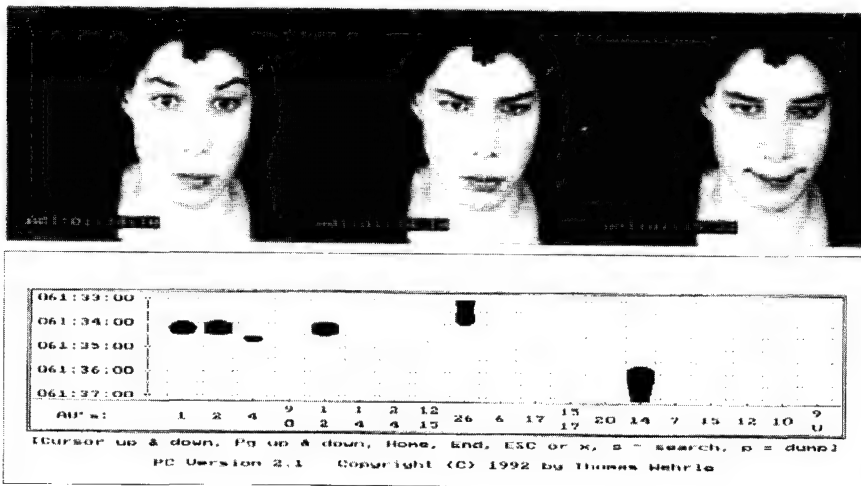
In their review of developments in emotion research, Cacioppo and Gardner (1999, p.192), concluded that "the measurement of emotion is a bustling research area." Since then, this area of research has grown even more. Not only the number of reported instruments but also the diversity in approaches is overwhelming. Today's instruments range from simple pen-and-paper rating scales to dazzling high-tech equipment that measures brain waves or eye movements. In this section, recent developments are briefly reviewed. The applicability of these instruments for the measurement of product emotions has been evaluated with respect to the requirements proposed in this chapter's introduction.

The reason for such a diversity of measurement instruments is the compound nature of emotions. In Chapter 1, we saw that emotions cannot be characterised by one single measurable phenomenon. Instead, emotions are multi-component entities, consisting of expressive reactions (e.g. smiling), physiological reactions (e.g. heart pounding), behavioural reactions (e.g. approaching), and subjective feelings (e.g.



**Figure 3-1 Facial Expression Analysis tool.**

Source: Kaiser and Wehrle, 2001. With the Facial Expression Analysis Tool (FEAT), facial actions are categorized in terms of the Facial Action Coding System (FACS; Ekman & Friesen, 1987). FACS is a coding system that allows coding of any facial action in terms of the smallest visible unit of muscular activity (Action Units), each referred to by a numeric code. With FACS facial expressions can be linked to emotions. The top part of the figure shows still pictures of facial expressions of the subject's face. The bottom part shows the results of the automatic FEAT coding, showing the distribution of Action Units over a period of four seconds.



feeling happy). All instruments that claim to measure emotions in fact measure one of these components. As a consequence, instruments can be classified in one of four classes with respect to the measured component. In the current section, the review of instruments is structured in accordance with these four classes.<sup>1</sup>

### **(1) Instruments that measure emotional expressions.**

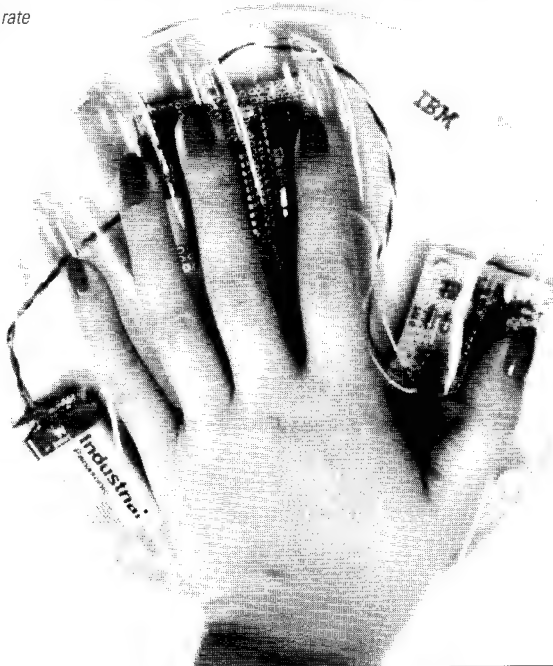
Instruments that measure expressions fall into two major categories: those measuring facial (see e.g. the 'facial expression analysis tool' in Figure 3-1)<sup>2</sup> and those measuring vocal expressions.<sup>3</sup> In the last few years, this class of instruments has gone through a remarkably rapid development. Technical advances in the area of digital signal analysis are paving the way for (future) reliable measurement tools of emotional expression. Especially promising are the instruments that include both facial and vocal expressions (see Johnstone & Scherer, 2001; Keltner & Ekman, 2001).

The major advantage of these instruments is that (in measuring basic emotions) they can be used in different cultures. A second advantage is that they are unobtrusive because they do not disturb subjects during the measurement. However, despite



**Figure 3-2 IBM's emotion mouse.**

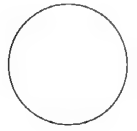
*The mouse measures ANS responses such as heart rate and sweat response.*



these advantages, at the present moment they also have some major disadvantages. First, and most important, at this stage they can reliably measure only basic emotions. Attempts to measure non-basic emotions with these instruments suffer from a lack of solid theoretical relationships between expressive patterns and non-basic emotions (see Johnstone, Reekum, & Scherer, 2001). Therefore, not all emotions that are often elicited by product appearance can be measured. Moreover, the measurement of mixed emotions is not supported by the theories that are used to interpret expressions. It is also fairly easy for people to control their expression if they know they are being observed. People often show 'display rules' to mask or hide the emotions they are feeling (e.g. Cacioppo, Bush, & Tassinari, 1992). Consequently, measured expressions cannot always be used to form conclusions on the actual emotions experienced. A final disadvantage is that, in spite of rapid developments, these instruments require complex technical equipment and expertise.

## **(2) Instruments that measure physiological reactions.**

Emotions are accompanied by a variety of physiological reactions, which can be measured using a diverse array of techniques. Examples of these are instruments that measure blood pressure responses, skin responses, pupillary responses, brain



waves and heart rate responses. Although diverse, each of these reactions results from changes in the autonomic nervous system (ANS; see Note 3 in Chapter 1). In the following discussion these techniques will therefore be referred to as ANS instruments. Researchers in the field of affective computing are most active in developing ANS instruments, such as IBM's emotion mouse (Ark, Dryer, & Lu, 1999) and a variety of wearable sensors designed by the Affective Computing Group at MIT (e.g. Picard, 2000).<sup>4</sup>

The major advantage of ANS instruments is that they measure responses that cannot be controlled by the subject, and are therefore claimed to be objective measurement tools.<sup>5</sup> A second advantage (similar to the first class of instruments) is that the ANS measurement does not disturb subjects during the emotional experience. Moreover, these instruments can be used for cross-cultural applications (see e.g. Levenson et al., 1990).

For the current research this class of instruments has several limitations. Despite much ANS research, the evidence for the existence of emotion-specific physiological responses remains inconclusive. Although some studies have presented evidence for the differentiation of discrete emotions on the basis of ANS measurements (e.g. Ekman et al., 1983; Levenson et al., 1990), several reviews have indicated that these results are far from definitive (Cacioppo et al., 2001). Based on a meta-analysis, Cacioppo and his colleagues concluded that even a limited set of basic emotions (such as *happiness*, *sadness*, *fear*, *anger* and *disgust*) cannot be (reliably) differentiated by ANS patterns alone.<sup>6</sup> It seems safe, therefore, to conclude that not all product emotions can be distinguished with the use of ANS patterns. Moreover, current ANS instruments cannot assess mixed emotions.

In addition, a frequently reported problem associated with the ANS instruments is that of noise in the signals. ANS signals not only represent emotional responses but also processes that are not related to the emotional response (e.g. the subject is feeling cold, hot, hungry, etcetera). Finally, the procedures demand input from expert technicians and the results can only be interpreted by experts of the particular physiological method.

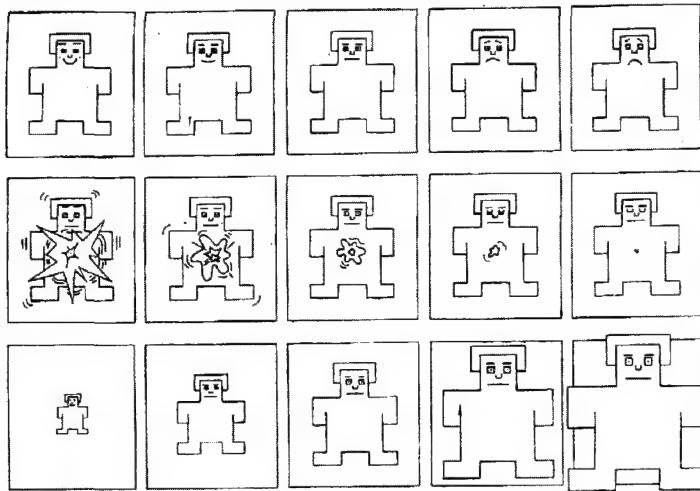
### **(3) Instruments that measure subjective feelings.**

The only means of assessing subjective feelings is self-report. The most often used self-report instruments require subjects to report their emotions with the use of a set of rating scales or verbal protocols. In addition to these *verbal instruments*, a handful of *non-verbal instruments* have recently been developed that use pictograms instead of words to represent emotional responses.<sup>7</sup> An example is the Self-Assessment Manikin (SAM; Lang, 1980; see Figure 3-3). With SAM, subjects point out the puppets which in their opinion best portray their emotion.



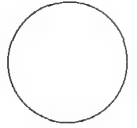
**Figure 3-3 Self Assessment Manikin.**

Source: Lang, 1980. With the Self-Assessment Manikin, subjects report their emotional response on three dimensions, i.e., 'pleasantness' (top row), 'arousal' (middle row), and 'dominance' (bottom row). Participants select a manikin of each row.



Both verbal and non-verbal instruments have their particular advantages and disadvantages. The two major advantages of the verbal instruments is that rating scales can be assembled to represent any set of emotions, and can be used to measure mixed emotions.<sup>8</sup> In addition, verbal scales are relatively easy to administer and to code. The main disadvantage of verbal self-report instruments is that they are difficult to apply between cultures. Many emotion words cannot be translated univocally, and are subject to culturally biased interpretations (Russell, 1989; Wiles & Cornwell, 1990). A second disadvantage is that emotions are often difficult to verbalise. Consequently, reporting emotions will require the cognitive involvement of the subject, which may influence the response and thus the measurement results (Scherer, 1986). These two disadvantages are largely overcome by the use of non-verbal self-report instruments. Nevertheless, these non-verbal instruments also have an important limitation, which is that they do not measure distinct emotions but only generalised emotional states (in terms of underlying dimensions, see Section 1.4). In addition, verbal and non-verbal instruments share two limitations. First, because emotional experiences can be delicate, subjects sometimes (consciously or unconsciously) manipulate their reports. According to Scherer (1986), self-reports are subject to distortions due to ego-defence tendencies and socially desirable effects. Moreover, relying on the subjects' memory is also a significant limitation. There is always a time-lapse between the experienced emotion and the self-report. The bigger the time-lapse between experience and report, the more the results are distorted (Scherer, 1986).



**Table 3-1 Instruments measuring emotions.**

Requirements	Measurement instruments			
	Emotional expression	Physiological reactions	Subjective feelings	
			Verbal	Non-verbal
Product emotion set	-	-	+	-
Mixed emotions	-	-	+	-
Cross-cultural	+	+	-	+
Equipment / expertise	-	-	+	+

*Note: the table is based on existing instruments (disregarding possible future developments).*

*-: does not meet the requirement; +: does meet the requirement.*

### Measuring product emotions

Table 3-1 summarises the advantages and disadvantages of the three classes of instruments. The table indicates that none of the reviewed instruments meets all four requirements. One issue shared by all the reviewed techniques is their construct validity. That is, are they really measuring emotions? As was discussed, people may (consciously or unconsciously) adjust their facial and vocal expression. In comparison, ANS instruments might measure physiological processes that are unrelated to emotions, and people can (again consciously or unconsciously) manipulate their self-report responses.

Notwithstanding this shared disadvantage, one class of instruments has some crucial advantages over the other classes: the self-report instruments. For two reasons this is the only feasible alternative for the current research. First, only this class of instruments can measure *mixed* emotions. Second, only these instruments can (at the present time) reliably measure emotions other than *basic* emotions. Table 3-1 indicates, however, that verbal self-report instruments are not suitable for cross-cultural application. Although non-verbal self-report instruments overcome this limitation, their disadvantage is that they cannot measure distinct emotions. Therefore the decision was made to develop a new non-verbal self-report instrument, specifically for the measurement of emotions elicited by product appearance: the Product Emotion Measurement instrument (PrEmo). This instrument was developed to combine the advantages of existing verbal and non-verbal self-report instruments: it measures distinct (and mixed) emotions but does not require subjects to verbalise their emotions. To avoid too much thinking on the part of the subjects, it was designed to be fast and intuitive in use. In the next sections the development of this instrument is reported.



### 3.3 The development of PrEmo; an overview

In the development of PrEmo two stages can be identified. In the first stage, three 'early versions' were developed (PrEmo-1 to 3), each based on insights obtained from experimenting with its predecessors. In the second stage, in three additional steps (i.e. PrEmo-4 to 6), the final version was created. Given the iterative design process, the final version can only be fully understood in the light of its predecessors. The current section presents an abridged chronological overview of the early PrEmo versions. This overview is restricted to a description of each version and the major findings of the evaluation studies that were performed. A detailed design report can be found in Appendix 2, which describes the starting points, the development, and an evaluation of each concept.

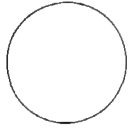
People are expert at interpreting emotional expressions. In the face-to-face encounters of everyday life we constantly monitor the emotions of others (Carroll & Russell, 1996). Does my question annoy him? Is she amused by my story? This monitoring skill is one of the first that we acquire. Studies have found that children as young as seven months old recognize and respond to facial expressions of emotions (e.g. Nelson & de Haan, 1997). Some researchers go so far as proposing that facial expressions provide the most effective means of communicating an emotion (Ettcoff & Magee, 1992).

This skill was the starting-point for the development of PrEmo. Instead of using words, respondents can report their emotions with a set of drawings of emotional expressions. It is assumed that this will allow for a self-report that is more intuitive than one based on verbal instruments.

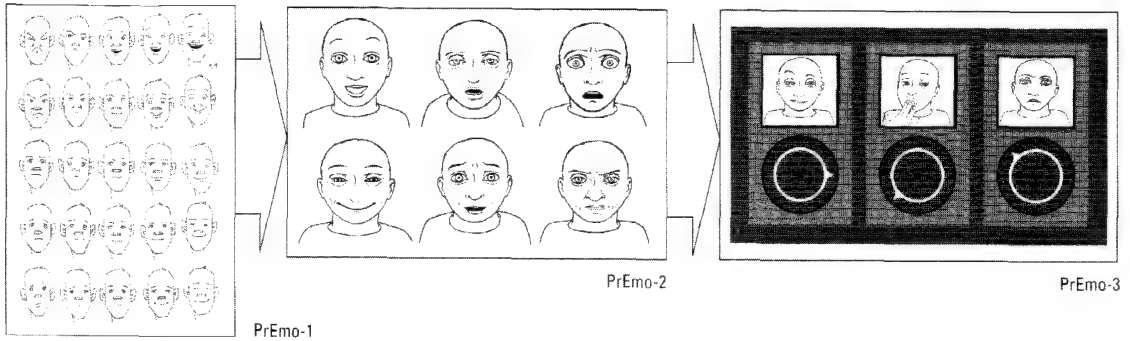
In Figure 3-4, the interfaces of the three early PrEmo concepts are shown. These first three instruments were used to find which medium is suitable for (reliably) portraying emotions, how many and what particular emotions should be measured, and what kind of interface allows for self-report that is fast and intuitive. Each of the three instruments is briefly explained, followed by a discussion of the major conclusions that were drawn from experimenting with these versions. Note that (as was stated in the introduction of this chapter) the development of PrEmo was closely intertwined with the development of the other two pillars of this research (i.e. the theoretical model and the inspirational tool), and therefore not all the requirements formulated in the introduction of this chapter have been met.

#### PrEmo-1

At this early stage of the project (see Appendix 2-1), it was decided to develop an instrument that measures *dimensions* of emotions. PrEmo-1 was therefore based on the two most commonly found dimensions of emotions: 'pleasantness' and



*Figure 3-4 Interfaces of the three early PrEmo concepts.*



'activation.' Twenty-five line-drawn faces are arranged in a 5 x 5 matrix and presented on a monitor. The expressions of these faces differ in pleasantness (i.e. horizontal axis) and activation (vertical axis). The interface operates in a 'pop up' fashion: faces are made visible by scrolling the mouse pointer over the cells. Participants report their emotion by selecting one of the 25 PrEmo-1 faces.

#### PrEmo-2

This version of the instrument was the first that was developed to measure distinct emotions. The instrument is a set of 41 plasticized cards, each portraying a face that expresses a distinct emotion. Each face represents one emotion of the set of 41 product relevant emotions developed in Chapter 2 (Figure A2-3 in Appendix 2 gives a full overview of the PrEmo-2 faces). Participants report their emotion simply by selecting one or more of the cards that, in their opinion, best portray their emotion.

#### PrEmo-3

In this version, line drawings of faces were applied that are similar to those used in PrEmo-2. Instead of using cards, for this version a computer interface has been developed. Another difference is that this instrument measures 18 instead of 41 emotions (see Appendix 2-3, and the discussion below). The interface displays three faces. Below each face a turn-button is placed, which the respondent uses to manipulate the face. By turning one of the buttons the emotional expression of the face above it can be changed. Each button represents six distinct emotions plus a neutral position. The buttons are modelled on the Circumplex of Emotions. Emotions on the left side of the button are 'unpleasant,' on the right side 'pleasant.' Emotions at the top are 'excited,' those at the bottom are 'calm.' To report their emotion(s), respondents turn the three buttons to combine a set of three facial expressions that best portray their emotion(s).



### Evaluation of the early PrEmo versions.

Designing, applying and evaluating the first three PrEmo versions produced some valuable insights related to: (a) portrayals of emotions, (b) the number of emotions to be measured and (c) the self-report with the use of drawings. This section reports the most important findings which served as the starting-points for the development of PrEmo-4 to 6.

#### (a) Portrayals of emotions.

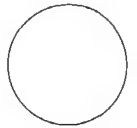
Studies performed with all early PrEmo versions supported the assumption that line-drawn faces allow for self-report that is fast, intuitive and pleasurable. In addition, it was found that not only can the basic emotions be (reliably) portrayed with line-drawings but also more 'cognitive-focal' emotions, such as *boredom* and *fascination* (see Section 2.5). These two findings indicated that the strategy of using line-drawn expressions of emotions for self-report is promising.

However, it was also found that the drawings used in the various PrEmo versions had some limitations. First, it was found that the faces were not able to show small detailed differences (e.g. *unpleasantly surprised* versus *alarmed*). In addition, it was found to be impossible to portray neutral emotions (i.e. emotions that are classified in Octant 4 or 8; see Figure 3-6), such as *astonished* and *concentrated*. It appears that people have a strong tendency to interpret a facial expression as either pleasant or unpleasant. Hence, the face that was designed to express, for example, *amazed* was always interpreted as expressing either *pleasant* or *unpleasant surprise* (see Figure A2-4 in Appendix 2).

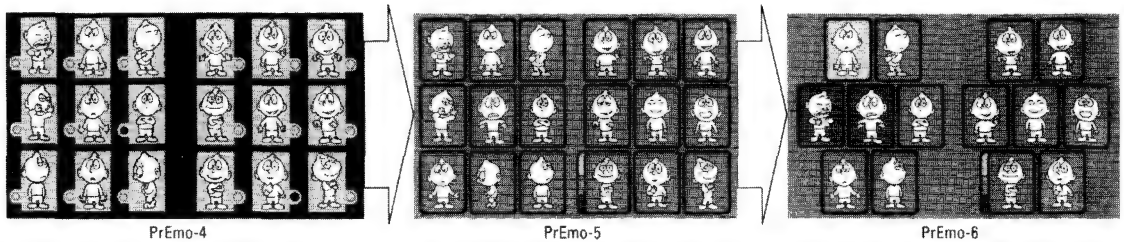
Given these strengths and weaknesses of the faces used, it was decided to stick with the strategy of using line-drawn expressions, but to abandon the faces. Instead, an animated puppet was designed that portrays emotions through the use of its dynamic facial, postural, and vocal expressions (see the discussion in Section 3-5).

#### (b) The number of emotions to be measured.

PrEmo has been developed to measure emotions that are often elicited by a product's appearance. The first version that measured distinct emotions was PrEmo-2. With this version, the aim was to measure *all* emotions from the set of 14 product relevant emotions that was developed in Chapter 2. The argument for this approach was that the emotions in this set were those most often elicited by product appearance. In explorative studies with PrEmo-2, it was found that this set of 41 emotions was too extensive. When the number of faces is more than approximately 20, respondents lose their overview and become confused. The assessment with an instrument that includes more than 20 faces is slow, and therefore less intuitive. This was the main motivation for reducing the set of measured emotions to 18 in PrEmo-3. Although a set of 18 emotions appeared to be sufficient for face validity (i.e.



**Figure 3-5 Interfaces of the three versions of the final PrEmo concept.**



respondents feel that this number of emotions is sufficient for satisfactory self-reporting), studies with PrEmo-3 however also indicated that the particular set of 18 emotions measured by PrEmo-3 was inadequate. Some emotions were redundant and others were missing (the selection of the set of emotions measured by PrEmo-3 is reported in Appendix 2). For the development of the final PrEmo version it was therefore decided to abandon the particular set of emotions measured by PrEmo-3. Instead, a new set was drawn from the set of 41 product relevant emotions. This selection, which is reported in Section 3.4, was based on a study and considerations with respect to experiences with the previous PrEmo versions.

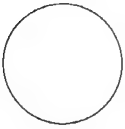
*(c) Self-report with the use of drawings.*

In the various experiments conducted with PrEmo-1 to 3, it was found that respondents wanted to be able to report more than one emotion per stimulus product (i.e. 'mixed emotions'). It was also found that the interface should be as simple as possible, to allow for fast and intuitive self-reporting. The interface must at all times display an overview of all portrayals (instead of using 'buttons' as was done in PrEmo-3). Moreover, respondents reported the need to be able to rate the portrayals with a scale (rather than merely "yes, I do feel this emotion," or "no, I do not feel this emotion").

**PrEmo-4 to 6**

These findings were used to develop PrEmo-4, PrEmo-5, and subsequently the final version PrEmo-6. The interfaces of the three PrEmo versions developed in the second stage are depicted in Figure 3-5. The differences between these three versions are much smaller than between the earlier three versions. The steps taken in the development of PrEmo-4 to 5 can be found in Appendix 2 (i.e. 2-4 and 2-5). The following describes the basic concept, which is similar for all three versions.

On a monitor the interface depicts a set of puppets. Each puppet represents an animation that portrays a distinct product-relevant emotion. The left side of the interface depicts unpleasant animations, and the right side depicts pleasant animations. When an animation is activated (by clicking on it), it portrays an emotion by means of



a dynamic facial, bodily and (in PrEmo-5 and 6) vocal expression. Respondents report their emotion(s) by selecting one or more animations. In PrEmo-4, an animation is selected using a bullet-tag at the puppet's side. In PrEmo-5 and 6, respondents use a three-point scale to rate each animation. When an animation is activated, the scale appears at the left side of the activated animation. Visual feedback is given by the background colour of the puppets which follows the colour of the rating scale.

In the final section, the interface and operation of PrEmo-6 are reported in more detail. The next two sections report the set of emotions that is measured by PrEmo-6, and the development of the animations.

### 3.4 Measured emotions – Study 4

To decide which emotions should be measured using PrEmo was an important issue. In the evaluation of PrEmo-2 it was found that the set of 41 product emotions developed in Chapter 2 was too extensive, and had to be reduced by at least half. Subsequently, different emotion sets were applied in the various ensuing PrEmo versions, but none seemed to be optimal. Several studies were performed to enable the selection of emotions on an empirical basis. Eventually, the set of 41 emotions was reduced to a set of 14 emotions, on the basis of an empirical study and some insights that were drawn from experiences over the years of experimenting with the various PrEmo versions. This section discusses the selection of the set of emotions measured by PrEmo-6.

The content validity of a measurement instrument is the extent to which the results obtained reflect the domain for which the instrument was designed (Carmines & Zeller, 1979). The content validity of PrEmo is determined by the set of measured emotions. As the instrument will be applied in studies involving all kinds of consumer products, PrEmo should measure a representative set of emotions that can be elicited by product appearance. The selection of this set of emotions needed to comply with two apparently contradictory requirements. First, as the instrument is aimed at measuring emotions elicited by a wide variety of consumer products, the set should be *comprehensive*. It should provide a broad overview of emotions that can be elicited by product appearance. Second, the instrument aims to measure spontaneous responses and should operate as fast as possible. Therefore, the set of emotions should be as *compact* as possible.

In Chapter 2, it was shown that some emotions are elicited more frequently by product appearance than others. Figure 3-6 shows the set of 41 product relevant emotions that was developed in that chapter. This set is in fact a composite of eight smaller subsets. Each subset includes emotions that are represented by one of the Circumplex octants. The emotions in a subset are those that are relevant for product appearance in comparison to emotions *within* the same octant. It is not known,

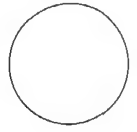
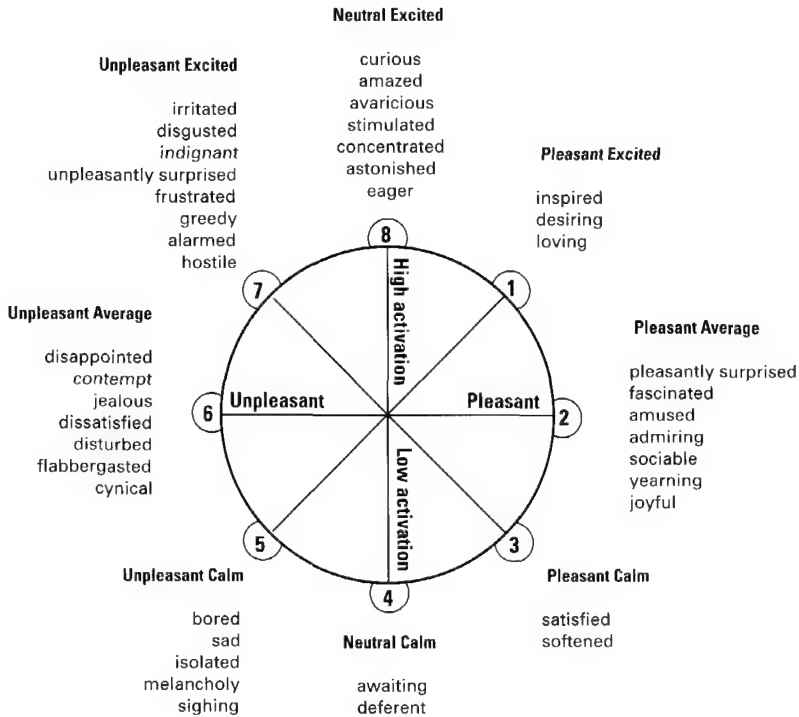


Figure 3-6 Categorised set of 41 emotions often elicited by product appearance.



however, what the relative relevance is of the emotions *between* octants. For instance, it is not known if *satisfied* is more, less, or equally as relevant as *inspired*. Therefore, in Study 4 the relevance of all 41 product emotions was assessed in comparison to *all* other emotions in the set, i.e. independent of their position within the Circumplex. The aim of the study was to identify and exclude from the set of product emotions those emotions that are relatively less relevant for product experience.

## Method

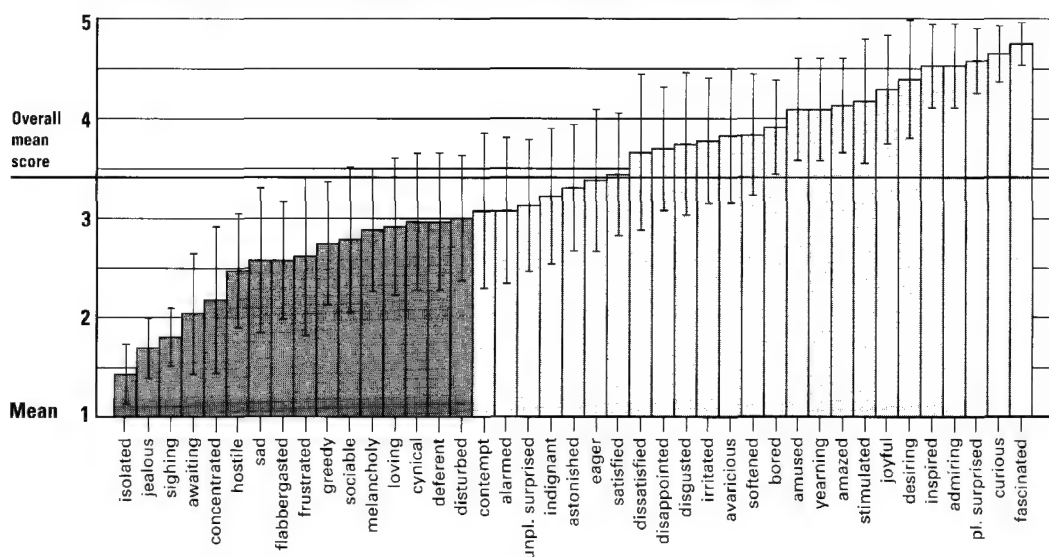
### Participants

Participants ( $N = 23$ ; 12 male, 11 female) were staff members ( $n = 7$ ) and doctoral students who had finished at least four major design courses ( $n = 16$ ) within the Department of Industrial Design Engineering at Delft University of Technology. These participants were selected because of their experience with product design. All participants were Dutch, with Dutch as their native language. The students were paid for their contribution.



**Figure 3-7 Relevance of 41 emotions for product appearance.**

The bars indicate the mean score of each emotion. 1: not relevant for product appearance; 5: very relevant for product appearance. Emotions represented by a dark grey bar have a mean score that is significantly below the overall mean score (3.42;  $p < .05$ ).



### Procedure

The experiment was conducted individually. Participants were instructed to distribute the 41 emotion words over five categories (ranging from 'very relevant to product appearance' to 'not relevant to product appearance at all'). In a written introduction it was explained that relevant emotions are those that are often elicited by product appearance, whereas those that are rarely elicited are not relevant. Participants were told that there was no restriction on the number of emotions they could place in each category. They were instructed to take as much time as they needed. After finishing the task, participants were given the opportunity to comment on their classification.

### Results

Each emotion was given a score in accordance with the placement ('not relevant':  $S = 1$ , to 'very relevant':  $S = 5$ ). The Mean score ( $M$ ) and standard deviation ( $SD$ ) of each emotion are shown in Figure 3-7. The mean score over all 41 emotions ( $Mo = 3.42$ ) is indicated by a vertical line. Since the aim of Study 4 was to exclude those emotions that are least relevant, it was decided to exclude all emotions that have a mean score that is significantly lower than the overall mean score. A one-sided t-test ( $Df = 22$ ) was executed to compute significance levels. The t-test results indicated that the mean scores of 16 emotions were significantly below  $Mo$  ( $p < .05$ ). These emotions were removed from the set, reducing it to 25 emotions (see Figure 3-8).



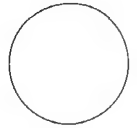
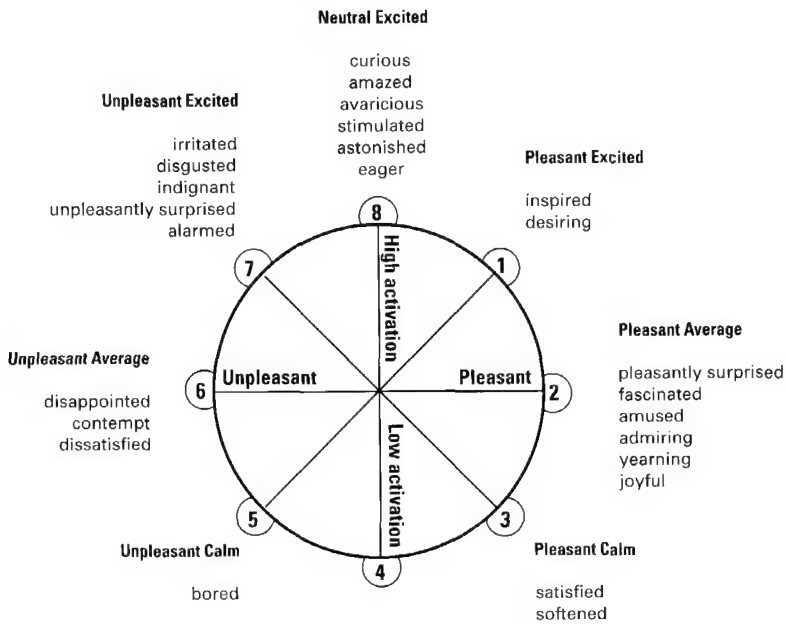


Figure 3-8 Categorized set of 25 emotions often elicited by product appearance.



## Discussion

As was mentioned in the introduction to this section, PrEmo-6 measures a set of 14 emotions. One might question why Study 4 was used to reduce the set to 25 emotions rather than using it to simply select the 14 most relevant emotions. The reason was that the final list was not only based on the criterion of product relevancy. The second criterion involved *comprehensiveness* of the set. To ensure this comprehensiveness, it was important to avoid both over-sampling and under-sampling of particular emotion types. On the basis of experiences gained from experimenting with the various PrEmo versions, it was decided that the set of 14 emotions with the highest scores in Study 4 did not meet the second criterion. This decision was based on two considerations: (1) balance and (2) similarity.

### (1) Balance

Thirteen of the 14 emotions with the highest mean scores are *pleasant*. This high number of pleasant emotions is remarkable because the research literature structurally reports more unpleasant than pleasant emotions (e.g. Frijda, 1970). In most languages there are more words that refer to unpleasant than to pleasant emotions (see e.g. Davitz, 1969 for the English language). The prevailing explanation for this uneven distribution is that when it comes to our unpleasant emotions we need to be



more precise in what we feel, and why we feel it. If we experience a pleasant emotion, on the other hand, it is not important to distinguish exactly what we feel and why we feel it; we simply feel good (e.g. Fredrickson & Branigan, 2001). The results of Study 4 indicate that, regarding product appearance, this may be the opposite way around. Perhaps, when we feel unpleasant emotion, we simply ignore the product. An alternative explanation for the 'unbalanced' results is the influence of the participants' design experience. The 'top five' emotions seem to refer to emotions that are typically felt by designers (e.g. *inspired* and *admiring*). If that is the case, these 14 emotions may not be representative of the emotional responses of people who do not have a design background.

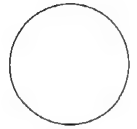
Given these considerations, it was decided to balance the set of emotions measured by PrEmo-4 (i.e. an equal number of pleasant and unpleasant emotions). As the results of validation and application studies (see Appendix 2-4 and Chapter 4) supported this decision, it was concluded that this symmetrical approach had been successful, and this strategy was therefore also used in PrEmo-5 and PrEmo-6.

## (2) Similarity

Some of the 14 emotions with the highest scores are very similar. First, the emotions *avaricious*, *yearning*, *eager*, and *desirous* are similar (and all refer to wanting to own or use the product). In the same way, *alarmed* is similar to *unpleasantly surprised*. In experimenting with PrEmo-2 (which aimed to measure all 41 product relevant emotions) it was found that these small differences cannot be captured with line-drawn portrayals. Moreover, these studies also indicated that it is not necessary to measure all six emotions. Including all these six emotions results in over-sampling 'desire-type' emotions and 'unpleasant surprise-type' emotions. In the light of the discussion with respect to balance and similarity, it was decided to make the final selection based on both the empirical findings and some practical considerations.

Step one: similar emotions. As has been discussed above, some emotions included in the set are very similar (see also the discussion on the development of PrEmo-2 in Appendix 2-2). The following emotions are too similar: *Desirous*, *avaricious*, *eager* and *yearning*; *alarmed* and *unpleasantly surprised*; *irritated* and *indignant*; *curious* and *fascinated*. Of these six emotions, only *desirous*, *unpleasantly surprised*, *indignant* and *fascinated* have been included in the PrEmo-6 set.

Step two: neutral emotions. In the development of PrEmo-2 it was found to be difficult, if not impossible, to create clear portrayals of neutral emotions (i.e. emotions in Octant 8 in Figure 3-8). It seems to be human nature to interpret an expression as either pleasant or unpleasant. It was therefore decided to omit the neutral emotions: *stimulated*, *astonished*, and *amazed*.

**Table 3-2 Emotions measured by PrEmo-6.**

Unpleasant emotions	Pleasant emotions
Indignation	Desire
Contempt	Pleasant surprise
Disgust	Inspiration
Unpleasant surprise	Amusement
Dissatisfaction	Admiration
Disappointment	Satisfaction
Boredom	Fascination

**Step three: PrEmo experiences.** Finally, two more emotions (i.e. *tenderness* and *joyful*) have been excluded. Initially, they had been included in PrEmo-3 to 5. It was decided to exclude them on the basis of findings in application studies. In multiple experiments, it was found that *tenderness* is much less relevant than was expected from Study 4. For example, in a study involving 49 different consumer products, it was found that *tenderness* was hardly ever experienced. Moreover, 26 out of 35 participants reported that this emotion was superfluous. *Joyful* was excluded because it is too general. It refers to a general pleasant feeling and therefore overlaps other pleasant emotions. In application studies with PrEmo-3 and 4, this emotion showed no discriminant validity with respect to other pleasant emotions.

The final set of product emotions measured by PrEmo-6 includes the 14 emotions presented in Table 3-2. Note that it is not claimed that this set includes all emotions that can be elicited by product appearance. It has been developed to be both representative and manageable. It is representative because it gives a cross-sectional overview of emotions that are often elicited by product appearance. It is manageable for two reasons. First, a number of 14 animations can be rated in a manner that is both fast and intuitive. Second, the emotions included can be differentiated with the use of emotional expressions.

### 3.5 Fourteen animations – Study 5

PrEmo's main feature is the set of animations. These animations were designed to permit clear and unambiguous portrayals of the 14 measured emotions. The research literature reports a wide variety of media for portraying emotions, varying from videotaped actors to abstract line drawings. Hence, two design challenges shaped the design process. First, a medium to portray the emotions (the puppet) was developed. Second, with this puppet, animations were created. These designs were based on a study with actors expressing given emotions. This section reports both the puppet design and the study conducted to create the animations.

Emotional expressions are a combination of facial, bodily and vocal expressions. In his famous book, Darwin (1872) was quite specific in ascribing dynamics of all three



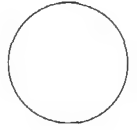
cues to specific emotions. According to Darwin (1872, p. 256), *disgust* for example is "often accompanied by a frown, and often by gestures as if to push away or to guard oneself against the offensive object [...] the mouth being widely opened, as if to let an offensive morsel drop out; by spitting; by blowing out of the protruded lips; or by a sound as of clearing the throat." Darwin underlined the important role of all three expression cues in the recognition of emotional expressions. It therefore seems remarkable that since Darwin the focus of most reported studies has been restricted to single cues only. Generally, researchers focus either on vocal, on bodily or on facial expression. Moreover, most reported studies focus on static (drawings of photographs) rather than on dynamic expressions (except for studies on vocal expressions).

Nevertheless, recent recognition studies report the significance of the dynamic expression of all three cues as carriers of emotional signals (i.e. vocal *and* bodily *and* facial expression). There is at least some evidence that body postures are also important in judging the emotional state of a person (e.g. Riskind, 1984; Wallbott, 1998a; Weisfeld & Beresford, 1982). Recently, Wallbot (1998b) even suggested that bodily expressions might be nearly as important as facial expression information in decoding emotional states. Some recent studies have been reported that examined the temporal dynamics of emotional expression. These studies showed promising results for non-basic emotion, such as sympathy and amusement (e.g. Keltner & Harker, 1998; Haidt & Keltner, 1999). Results of perception studies indicate that emotions expressed in speech can also be detected successfully, to a large extent (Johnstone & Scherer, 2001; see also Banse & Scherer, 1996). Given the current aim to create clear and unambiguous expressions of the 14 emotions, it was decided to use all three cues, and to create dynamic rather than static portrayals of emotions.

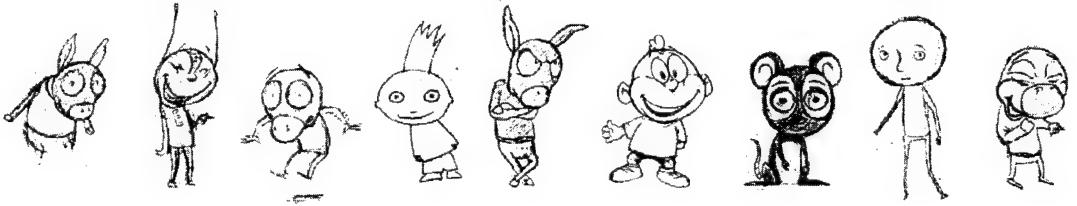
### **The cartoon puppet**

Emotional expressions can be visualised in many different ways. Some examples found in the research literature are line drawings, animated cartoons, computer-generated manikins, facial pictures and videotaped actors. The various approaches differ in two major dimensions: the level of *abstraction* and the level of *amplification*.

The level of abstraction ranges between human expressions (realistic) and simple line drawings (abstracted). The function of abstraction is to reduce the emotional expression to its essence (e.g. Rhodes, Brennman, & Carey, 1987). All human expressions include information irrelevant for communicating emotions. For example, hairstyle, age and eye colour are cues that do not differ between emotions. Those cues can be removed without compromising the emotional expression (Ettcoff & Magee, 1992). Abstracting can make the task of recognizing emotional expressions *easier* because the amount of distracting irrelevant information is reduced (Bernson & Perrett, 1991).



*Figure 3-9 Selection of idea sketches for the puppet.*



The second variable is the level of amplification. We are all familiar with the caricatures that are drawn by artists in places like the Centre Pompidou in Paris. These drawings exaggerate facial features that are typical of the person being portrayed. Typical features are those that distinguish the model's face from the average. The same technique can be applied to the expression of emotions. In that case, amplification refers to the amount of exaggeration of those expressive cues that differ between emotional expressions. Calder et al. (1997) found that caricatured pictures of facial expressions were identified significantly faster than non-caricatured pictures. Given their positive effect on the identification of emotional expressions, it was decided to apply both abstraction and amplification in the design of the PrEmo puppets.

Probably the best examples of highly amplified and abstracted emotional expression can be found in cartoon animations. Cartoon figures can be small because they are extremely 'space efficient' in expressing their emotion. This space efficiency is a second benefit of both abstraction and amplification. The puppets must be relatively small because the animations will be used in a measurement instrument that operates on a computer.

A professional animator designed the puppet and created the animated expressions. The puppet was designed in the light of two requirements. First, the emotional expressions of the puppet should be clearly recognizable, even when scaled to a minimum height of 30 mm. Second, the puppet should be emotionally as 'neutral' as possible when not expressing an emotion. Although absolute neutrality does not exist, the puppet 'as such' should not stir strong emotional responses. Figure 3-9 shows some idea sketches developed by the cartoon artist, and the final choice.

For reasons of abstraction and amplification, the head of the puppet is disproportionately large, because the information given by the face is much more detailed than the information given by the body. In the development of PrEmo-1, participants did not show a preference for either a male or female character. As a sexless character seemed to be considered unnatural (and therefore less neutral), it was decided to choose a male character.



### Developing the animations

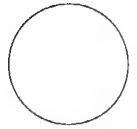
Following in Darwin's footsteps, many researchers have created protocols or descriptions of patterns of expressions associated with specific emotions. One of the most famous is the facial action coding system (FACS) developed by Ekman and Friesen (1975, 1978). The FACS protocol specifies detailed facial muscular movement for a set of eight emotions. This protocol exemplifies two major limitations of existing protocols for application in the designing emotion research. First, they generally focus on either bodily (e.g. Meijer, 1989) facial (e.g. Carroll & Russell, 1996) or vocal (e.g. Banse & Scherer, 1996) expression. The combination of these cues has never been studied (see Wallbott, 1998a). Second, none of the protocols includes all 14 PrEmo-6 emotions. Therefore, it was decided not to base the animated expressions on existing protocols but on a study with actors expressing the product emotions.

### Study 5: Portraying Emotions

Protocols of emotional expression can be based on either real or posed expressions. Although this choice is surrounded by some controversy, the large majority of studies of emotional expression have used posed expressions (Zuckerman et al., 1976). As the current aim is to develop valid animated expressions, the use of posed expressions seems also most appropriate. Ekman and Friesen (1971) suggested that, although eliciting circumstances for posed and spontaneous cues are different, the cues themselves are similar. In fact, some authors have reported that posed expressions are *more accurate* than spontaneous expressions (e.g. Motley & Camden, 1988). Furthermore, access to and recording of spontaneous emotional expressions is difficult and problematic from an ethical point of view (see Wallbott & Scherer, 1986). Given these considerations, the animations are based on *posed* expressions.

According to Wallbott (1998a), most of the studies on posed expressions of emotions suffer from two problems. First, in most cases only one actor or actress is used. Yet there is considerable evidence that actors differ to a large degree in their ability to portray emotions (Wallbott & Scherer, 1986). This problem can be avoided by using more than one professional actor. Second, actors are often only given emotion labels to describe the emotional state they are to portray. The problem is that different actors may attribute different meanings to such labels, and that they may envisage different situations inducing these emotions. Such problems can be avoided by using a scenario approach (see Williams & Stevens, 1972; Rosenthal et al., 1979). In this approach, actors are provided with situation vignettes or short scenarios describing an emotion-evoking situation. They are instructed to imagine these situations and act as if they were in such a situation.

A third problem, particularly relevant for the current research aim, is the possible occurrence of cultural differences between the actors' portrayals. The animations are



incorporated in an instrument that will be applied in different cultures. Therefore, it seems appropriate to base the animated expressions on actors from different cultures. However, Ekman (1999b) claimed that differences of emotional expressions between cultures are smaller than they sometimes seem. These cultural differences are mostly the result of differences in display rules (over-learned habits about who can show what emotion to whom, and when they can show it). In fact, Ekman (1999b) claimed that the *recognition* of emotional expression is universal (although the actual expressed emotion is partly determined by cultural differences). Note that this point of view is the topic of a heated debate among those studying emotional expression (see e.g. Russell, 1994). Therefore, and also for practical reasons, it was decided to base the animations on Dutch actors only. Nevertheless, the resulting animations have subsequently been validated in various cultures (see Chapter 4).

## Method

### Participants

In order to avoid the single encounter problem, four actors (two males and two females) participated. All were professional actors who regularly participate in theatre productions. The actors volunteered to participate and were given a small present for their participation.

### Procedure

Audio and video recordings were collected in a studio. Each actor and actress was (individually) allowed to practice the emotions before the recording started. The actors were then instructed to portray the 14 emotions three times. First, they expressed the emotions twice without witnessing each other's portrayals. Subsequently, they were allowed to practice and discuss the portrayals with each other, and then asked to express the emotions a third time. Actors were instructed to express the emotions as clearly as possible. The only restriction was that they were not allowed to use words.

A simple scenario approach was adopted. A plain product (a coffee cup) was placed on a stage in front of the actor. This product was covered with a white handkerchief. The session leader said to them: "Imagine that this product makes you feel *bored*." Subsequently the cloth was removed and the actor acted as if the coffee cup made him or her feel *bored*. This procedure was repeated for each emotion (the sequence of the emotions was randomised). The act of removing the handkerchief was used to mark the beginning of the portrayal.

## Results & Discussion

The resulting portrayals have been edited on videotape. All 12 portrayals for each emotion were edited serially. This editing facilitated accurate analysis of both the sim-

**Table 3-3 Emotion expression types.**

Linear	Non-linear	
	Startle	Narrative
Disgust	Indignation	Dissatisfaction
Unpleasant surprise	Pleasant surprise	Disappointment
Contempt	Admiration	Boredom
Fascination		Inspiration
		Desire
		Amusement
		Satisfaction

ilarities and differences between the actors. A global examination of the portrayals suggested that there are three types of emotional expressions (see Table 3-3).

First, the actors portrayed some emotions with 'linear' expressions. Linear expressions start from neutral and end with the most pronounced expression. The sequence between neutral and end-expression can be seen as a linear development from start- to end-point. *Disgust* for example, comes with a typical linear expression (see also Figure 3-10). Second, there are emotions with non-linear expressions that include a 'startle response.' These expressions start with a reflex-like startle response (eyes are squeezed, head slightly tilted forwards; eyes are opened and head back in upright position) as if the person has been hit by the stimulus. After this startle response, the actual emotion is expressed. A third type of emotional expression comprises non-linear emotions with a narrative character. Narrative expressions seem to portray a 'little story'. The best example of a non-linear narrative expression is *inspired*. At first the expression is thoughtful, as if trying to find a solution to a difficult problem. Then, suddenly, the answer is found and the expression shows an 'aha Erlebnis.'

Note that the PrEmo-6 emotions that are often found in basic emotion lists (see Chapter 1; Table 1-2) all fall into the *linear* category. These lists of basic emotions are generally based on research with photos of facial expressions (see e.g. Ekman, 1971). Only linear expressions can be captured with photographs, because non-linear ones rely on the dynamics of the expressions. The fact that 10 of the 14 product emotions are expressed non-linearly, illustrates the importance of including the dynamics in the PrEmo animations.

#### The animations

The videotaped actors were viewed by and discussed with the cartoon artist. Based on this discussion the animator drew 18 animations, each consisting of approximately 10 to 15 stills. Figure 3-10 shows three examples of animation sequences (i.e. *inspiration*, *disgust*, and *admiration*).



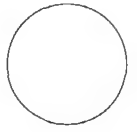
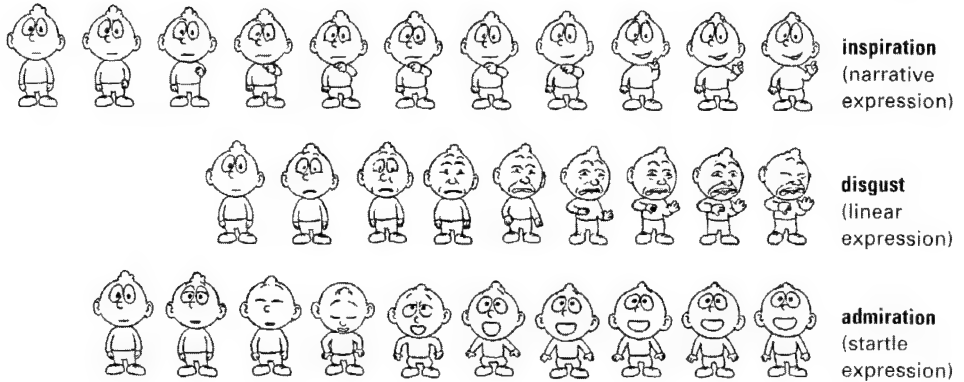


Figure 3-10 Three animation sequences.



### Sounds

The animations were developed for PrEmo-4. At that time, it had not yet been decided to include vocal expressions. These PrEmo puppets' vocals were only added in the subsequent version (PrEmo-5). In the development of these sounds, it was decided not to use those made by the videotaped actors of Study 5 for two reasons. First, the recording quality of the sounds was inadequate. Second, the sounds made by the actors were difficult to synchronise with the puppets' portrayals. The research literature reports some studies investigating vocal expressions of emotions. These studies were not used as the basis for the PrEmo-puppet sounds because they do not focus on sounds accompanying emotional expression. Instead, they focus on the influence of emotions on our voices (e.g. articulation, speaking rate and intensity). It was therefore decided to follow an approach similar to the one followed for the development of the animations.

First, six actors were instructed to voice-over all 14 puppets. The actors were given an emotion word and shown the corresponding animation. They were instructed to imagine that the puppet expresses the given emotion. Subsequently, they produced the sound that in their view accompanied the particular puppet's expression. They were allowed to make any kind of sound but to avoid using words. A professional 'vocal actor' was hired who had extensive experience in synchronised voice recording for cartoon movies. The six recordings for each emotion were discussed with this actor. On the basis of these six sounds, he first created 'rough' versions. Subsequently, the definitive (synchronised) sounds were recorded in a sound studio. After the sounds had been recorded, their pitch was heightened slightly to fit the cartoon puppet's character.



### 3.6 The final product emotion measurement instrument

The Product Emotion Measurement instrument (PrEmo-6) measures 14 emotions that are relevant for (i.e. often elicited by) product appearance. Typical of this instrument is that, although based on self-report, it avoids the use of words. Instead, it comprises 14 animations, each portraying a distinct emotion. Respondents can rate these puppets in accordance with their response to a particular product. This section discusses the instrument's interface, procedure and structure. The dynamics of the PrEmo interface can be experienced with the demonstration version that was included on a cd-rom with this thesis.

The 14 puppets require an interactive interface to enable respondents to report their emotions. In Section 3.2 we saw that a central issue in the development of all self-report instruments of emotions is that the time-lapse between experience and measurement should be as short as possible. Therefore, the interface was designed to be simple and intuitive in use.

First, respondents are shown a (picture of a) product. Subsequently they are instructed to use the animations to report their emotion(s) elicited by that product. While they view an animation, they must ask themselves the following question: "does this animation express what I feel?" Subsequently, they must use a three-point scale to report their answer to this question. Figure 3-11 shows the PrEmo-6 measurement interface.

The procedure of a PrEmo-6 measurement is self-running. The computer screen displays instructions that guide respondents through the procedure. The program's heart is the measurement interface, which is divided into two sections. The top section depicts (1) stills of the 14 animations. Each puppet is (2) accompanied by a (hidden) scale. The lower section of the interface displays (3) a picture of the stimulus and (4) an operation button.

#### (1) Puppets

The 14 animations are divided into two sections. The left section represents seven animations which each portray an unpleasant emotion. The right represents seven animations which each portray a pleasant emotion. The animations are displayed in a fixed order to facilitate fast and intuitive rating. If, for each stimulus, animations are placed in a randomised order, respondents will be confused and their report delayed. Animations will only run when a respondent clicks on the puppet that represents that animation. Each animation runs for approximately one second.

#### (2) Scale

Respondents rate the animations on a three-point scale. This scale represents the following ratings:

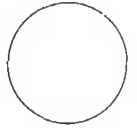
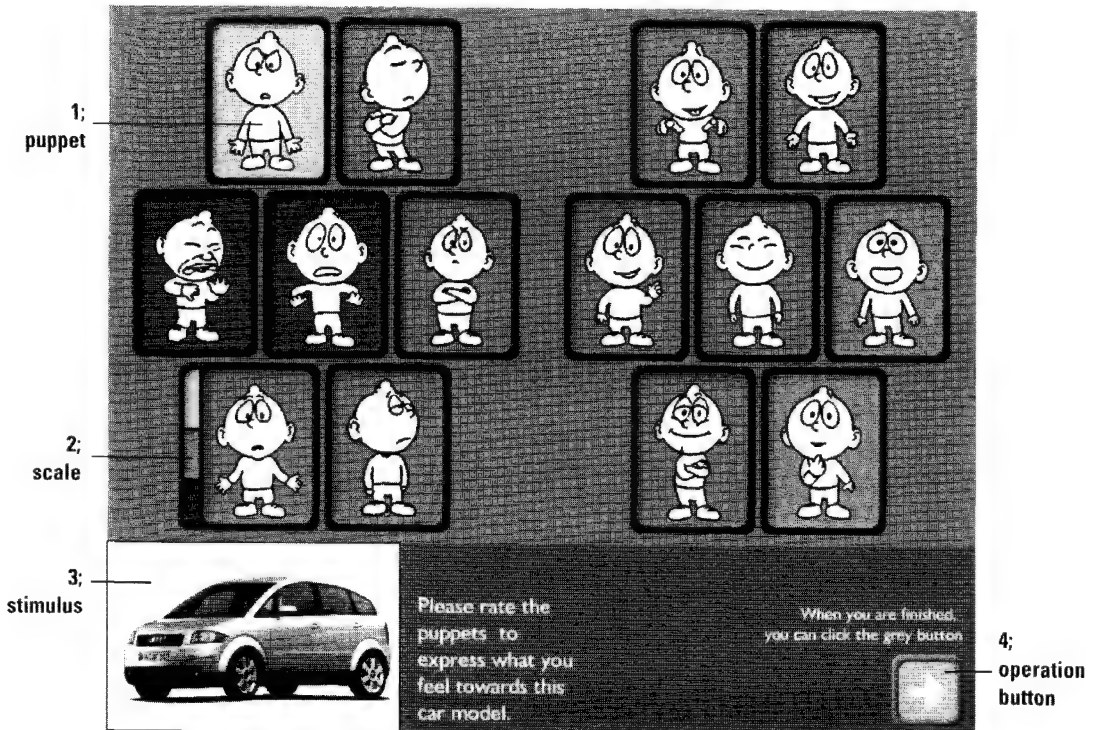


Figure 3-11 PrEmo-6 interface.

A computer interface depicts 14 puppets that each represent a distinct emotion (seven unpleasant, and seven pleasant).

The puppets are animated: when clicked on, they will portray an emotion, dynamic in facial, bodily, and vocal expression. Participants report their emotions by rating the animations on a three-point scale. When a puppet is activated, an animation of the emotion is shown and subsequently a three-point scale appears at the left side of the puppet. Participants can use this scale to report their emotion. Visual feedback is given by the background color of the puppets that follows the color of the rating scale.



Top part: I do feel the emotion expressed by this animation

Middle part: To some extent I feel the emotion expressed by this animation

Bottom part: I do not feel the emotion expressed by this animation

The rating scales are 'hidden behind' the animation frames. A scale belonging to a particular animation appears on the side of this frame only after the particular animation is activated. In this way, respondents are forced to view an animation before they can rate it. As stated above, an important aspect of PrEmo is the dynamic quality of the animations. In experimenting with PrEmo-4 it was found that 'lazy rating' (i.e. rating the stills instead of the animations) occurs when respondents are not forced to watch the complete animation before rating. As these stills do not



portray the intended emotions unambiguously, this 'lazy rating' should be avoided.

Respondents are provided with direct visual feedback of their scorings by the background colour of the animation frame. This background colour follows the colours of the three-point scales: *blue* stands for "I do not feel this emotion;" *dark yellow* stands for "to some extent I feel this emotion," and *bright yellow* stands for "I do feel this emotion."

An important feature of PrEmo-6 is that respondents are forced to rate all animations. This feature is important because in this way respondents must also report which emotions they do *not* experience. If respondents are not obliged to rate all animations, they will tend to rate only three or four and ignore the others. In that case, it would not be possible to conclude whether or not a 'not' rated animation represents an emotion that is not experienced. Although required to rate all animations, respondents are free to choose the order in which they rate them.

### (3) Stimulus

PrEmo has been developed to measure emotions elicited by the appearance of any kind of consumer product. The instrument has been used to measure emotions evoked by telephones, kettles, chairs and cars. These emotions are not necessarily the same as those often elicited by *using* products (e.g. driving a car, working on a computer), or by other kinds of stimuli (e.g. music or social interactions). Therefore, PrEmo may include emotions that are never elicited by these other types of stimuli, or emotions that are often elicited by those stimuli may be missing. The application of PrEmo is therefore restricted to product appearance.

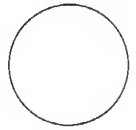
Note that the stimulus depicted on the interface is only a thumbnail sketch that functions as a memory aid. The actual stimulus (either a full screen picture or a real product) is presented before the PrEmo measurement interface appears.

### (4) Operation button

At any time, the respondent has an overview of his or her ratings, and these ratings can be adjusted as long as the operation button has not been pushed. Respondents can push the operation button when they have finished all of their ratings. If the operation button is pushed before all puppets are rated, the interface will prompt the statement "you have not finished the task. Please rate all puppets."

### PrEmo-6 measurement steps

In the above section, PrEmo-6's measurement interface was discussed. Besides the actual measurement, a PrEmo assessment includes some other steps. The five self-running steps are as follows (in chronological order):



- (1) *Introduction.* In the introduction, the respondent is welcomed and the goal and the procedure of the study are explained. It is stressed that it is not them but the products that are the objects of study.
- (2) *Explanation of the PrEmo procedure.* The PrEmo animations are introduced. Respondents are told how they can use these animations to report their emotions. This explanation is shaped as an interactive step-by-step procedure.
- (3) *Training with PrEmo.* After the explanation of PrEmo, respondents practice the PrEmo measurement procedure with two dummy stimuli. They are allowed to repeat the exercise as often as they feel is required. Moreover, at that time, respondents are given the opportunity to ask questions regarding the procedure and the use of PrEmo.
- (4) *The actual test.* As soon as respondents have finished practising using the PrEmo, the actual test begins. First, respondents are presented with an overview of all stimuli (for approximately 10 seconds). Subsequently, the stimuli are presented in a randomised order, and for each stimulus respondents are instructed to report their emotional response.
- (5) *Ending.* After rating all stimuli, respondents are informed about ensuing procedures (e.g. filling out questionnaires) or thanked for their participation.

#### Operating PrEmo-6

To enable researchers to customize the PrEmo procedure, the program has some built-in adjustment possibilities. First, the number of stimuli is not fixed. The dummy stimuli used for the practice procedure can be changed (standard are two chair models. These might be inappropriate when, for example, the actual experiment also involves chair models). The ending procedure can be adjusted to instruct respondents about ensuing tasks. Furthermore, the introduction can be adjusted to inform the respondents about the aim and procedure of the research.

In the following two chapters a validation (Chapter 4) and an application (Chapter 5) of the Product Emotion Measurement instrument are reported and discussed.

#### Notes

- [1] Instruments that measure the third component of emotions, i.e. behavioural reactions, are not reported in the research literature. It is understandably difficult to develop such instruments because behavioural reactions are in most cases overruled by display-rules (e.g. Frijda, 1986). Note that some interesting research initiatives have been reported in the field of design research. For example, recently an alarm clock was developed that aims to recognize emotional behaviour through the characteristics of the users interaction (Wensveen, Overbeeke, & Djajadiningrat, 2002).
- [2] Facial expression instruments are based on theories that link expression features to distinct emotions. Examples of such theories are the Facial Action Coding System (FACS; Ekman & Friesen, 1978), and the Maximally Discriminable Facial Movement Coding System (MAX; Izard, 1979). Facial expression instruments generally analyse visible expressions captured on stills or short video sequences. An example is the Facial Expression Analysis Tool (FEAT; Kaiser & Wehrle, 1992). As well as the visible expressions, subtle expressions



invisible to the naked eye can also be measured. The facial muscle activity of these subtle expressions results in electrical potentials (facial electromyographic activity: EMG). This EMG activity can be assessed by determining the voltage from two electrodes placed on the skin's surface over a particular muscle group (see Cacioppo & Petty, 1989). Whereas instruments based on visible expressions can only measure high-arousal emotions, EMG instruments are also capable to measure low-arousal emotions (e.g. Vrana, 1993).

- [3] The first-generation vocal expression instruments could only measure changes in arousal (based on voice pitch analysis). An example of such a measure, which has often been used to measure responses to advertising, is VOPAN (Brinkman 1976, 1980). Modern instruments measure the effects of emotion in multiple vocal cues such as average pitch, pitch changes, intensity colour, speaking rate, voice quality and articulation. With these multiple cues, six to eight basic emotions can be distinguished. Like the facial expression instruments, these modern vocal instruments are based on theories that link patterns of vocal cues to emotions (e.g. Scherer, 1989; Johnstone & Scherer, 2001). Reported studies find a recognition accuracy of around 60-75% for six to eight emotions (see e.g. Polzin, 2000).
- [4] With these instruments, computers can gather multiple physiological signals while a person is experiencing an emotion, and learn which pattern is most indicative of which emotion. Later, when the system is given only raw signals, it can use what it has learned previously to try to recognize which emotion most likely gave rise to the signals. Although research on this kind of recognition is immature, with pattern recognition Picard (2001) and her colleagues have achieved recognition rates of 81 percent accuracy for a set of eight emotions.
- [5] Early research on autonomic activity and emotions appeared to be characterised by a lack of replicability and generalizability (Cacioppo et al., 2001). Despite the lack of consistency in early findings, the belief that ANS instruments differentiate discrete emotions remained – and remains – popular. This popularity is probably strongly influenced by the alluring idea that ANS activity allows emotions to be measured *objectively*. As subjects can manipulate (the expression of) all other emotion components (i.e. expression, subjective feeling and behaviour), the researcher can never be fully sure whether or not the measurement reveals the actual experienced emotion. Physiological changes, on the other hand, are (to a large degree) beyond our control and are therefore believed directly to reveal our true emotional response.
- [6] One thing that is widely agreed upon is that no *single* signal is a reliable indicator of emotional response. Instead, patterns of signals are required to distinguish between emotions (e.g. Levenson, Ekman, & Friesen, 1990).
- [7] A third class of self-report instruments are the *continuous* instruments. These instruments were developed specifically to measure emotions elicited by non-temporal stimuli, such as music (2DES; Schubert, 1996) and television ads (the 'warmth-monitor,' Aaker, Stayman, & Hagerty, 1986). The use of continuous measuring is promising for measuring the dynamic emotional responses elicited by owning or using a product. The present research, however, is focused on momentary emotions elicited by a static product appearance. This type of instrument is therefore not discussed.
- [8] Traditionally, self-report instruments have been developed in the field of psychology. Given the dominance in this field, those instruments typically aim to measure basic emotions. An often-applied example is the Differential Emotions Scale (DES; Izard, 1977; figure F-6.9), which measures Izard's 10 basic emotions. In the eighties, researchers in other fields, i.e. consumer and marketing research, became interested in measuring emotional responses. Initially, they used instruments developed by psychologists. However, as not only the basic emotions appeared to be relevant for these researchers, they have revised or adapted existing instruments for use in the consumer context (Richins, 1997). Although these instruments are very similar to those developed in psychology, they differ with respect to the emotions included in the scales (e.g. Stayman & Aaker, 1988; Bagozzi & Moore, 1994).

# 4: Product emotion measurement instrument validation



## 4.1 Introduction

The Product Emotion Measurement tool (PrEmo-6) was developed to measure emotions elicited by product appearance. It measures seven pleasant and seven unpleasant emotions. These fourteen emotions represent a manageable cross-section of all emotions that can be elicited by product appearance. The development of PrEmo-6 was presented in the previous chapter. Particular to this instrument is that, although it is based on self-report, it avoids the use of words. Instead, PrEmo uses 14 animations which each express a distinct product relevant emotion. Participants can rate these animations in accordance with their emotional responses to a particular product.

Crucial for any measuring instrument is its validity. Validity is the degree to which an instrument accurately measures what it is supposed to measure (Carmines & Zeller, 1979). Hence, PrEmo-6's validity is the degree to which it accurately measures emotions elicited by product appearance. As PrEmo-6 includes animations instead of verbal scales, two validity issues are at stake. The first is the validity of the animations, i.e. do these animations accurately portray the emotions they are supposed to portray. The second type of validity concerns the instrument, i.e. can participants adequately report their emotions with the instrument (instruction and animations). These two issues have initiated a two-step process in the assessment of PrEmo's validity.

The first step (Study 6) was to examine the validity of the animations. An important requirement that had to be met by PrEmo-6 was that it should be applicable in different cultures or language areas. This requirement was a prime motive for developing the animations as an alternative to using words. Given this requirement, the study included participants from four different countries (Japan, United States, Finland and The Netherlands). This study is reported in Section 4.2.

In the second step (Study 7), the validity of the measurement instrument was examined. In this study, both PrEmo-6 and a verbal scale were used to measure emotions evoked by six different chair designs. The level of association of the results obtained with PrEmo and those obtained with the verbal scales was assessed. Also, an investigation was carried out to see if the chair models could be differentiated on the basis of the emotions they elicited according to PrEmo. This study is reported in Section 4.3. In Section 4.4, the results of Study 6 and 7 are discussed.

## 4.2 Validation of the PrEmo-6 animations – Study 6

In this section, the validation of the 14 PrEmo-6 animations is reported. A central issue in this validation is that of intercultural differences. As the animations were developed using the expressions of Dutch actors and actresses, there might be a cultural bias. Therefore, these developed animations have been validated in four different countries: The Netherlands, Finland, Japan, and the United States of America.



In a PrEmo-6 experiment, participants used 14 animations to report their emotion(s). The validity of these animations is the degree to which they accurately portray the emotions they are meant to portray. This validity is important because invalid animations will result in invalid conclusions with respect to the emotions experienced by the participant. The first aim of Study 6 was therefore to evaluate the validity of the animations.

In this study, special attention was paid to cross-cultural validity because the animations were based exclusively on portrayals by Dutch actors. It was therefore not known if participants from other cultural backgrounds would be able to interpret the animations' portrayals as accurately as Dutch participants. On the one hand, in the research literature indications can be found that the recognition of (facial) emotional expressions is culture-independent (e.g. Ekman & O'Sullivan, 1987). Studies conducted in dozens of cultures have demonstrated that people across cultures judge posed facial expressions of emotion with levels of accuracy that convincingly exceed chance level (see Ekman, 1994b; Russell, 1994). These findings are also supported by results from cross-cultural studies of actual emotional expressions (e.g. Camras et al., 1992). On the basis of these reported findings it can be hypothesised that the interpretation of the PrEmo animations is culturally independent. On the other hand, the reported cross-cultural studies of emotional expressions all focus on *basic* emotions, which are different from those portrayed by the animations. For this reason, in Study 6 respondents from four countries participated.

The second aim of Study 6 was to evaluate the reliability of the animations. A measurement instrument is reliable if on repeated measurements it yields the same results (e.g. Carmines & Zeller, 1979). Thus, an animation is reliable if a participant's interpretation of the emotion expressed by the animation does not change over time.

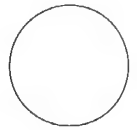
### **Study 6: Animations' validation**

Many recognition studies have been done using pictures of facial expressions of emotions. Most reported studies follow the same procedure: participants are shown a set of pictures of emotional facial expressions and asked, for example, "which of these faces best expresses *surprise*?" When the number of participants who select the correct facial expression is significantly above chance level, this facial expression is considered to be valid.

It was decided to follow a similar approach in the current study. Participants were shown three animations and were asked which of these three best portrayed a given emotion. Of the three animations shown, one was designed to portray the given emotion and the other two portrayed other emotions. The animation that was supposed to portray the given emotion was considered valid when it was selected more often than could be expected from chance.

The reliability of the animations was assessed by retesting them with the same





respondents one month after the initial test. An animation was considered unreliable when the number of participants who selected it in the retest differed significantly from the number (of participants) who selected it in the initial test. In addition, with a sign test, the within-participant consistency of the test and retest responses was assessed for each animation.

## Method

### Participants

The participants ( $N = 120$ ) were undergraduate students (Japanese  $n = 29$ ; U.S. citizens  $n = 29$ ; Finnish  $n = 33$ ; and Dutch  $n = 29$ ) with approximately an equal number of males and females.<sup>1</sup> They were recruited from local universities (except for the Japanese participants who were recruited by a professional agency). None of the participants were familiar with the animations before they were enrolled for this study. For practical reasons, only Dutch participants ( $n = 26$ ) took part in the retest study. All participants were paid.

### Material

The animations were presented using a video projector and a specially written computer program. The participants' responses were recorded in booklets containing 14 pages. Because the task was to select one of three presented animations, each page depicted a multiple-choice scale (which was used to select animation A, B, or C). Both the introduction and the test were completed in the participants' mother language. Therefore, four versions of the booklet and the computer program were created; one in Dutch, one in Finnish, one in Japanese and one in English. Translations of the emotion words are shown in Table 4-1.

### Procedure

Participants performed the experiment in small groups ( $n = 3$  to 8). They were not allowed to communicate with each other during the session. The experiment with the Japanese participants was conducted in Tokyo, the Finnish in Helsinki, the Dutch in Delft and the U.S. citizens in Palo Alto (California). In a short introduction, the purpose and the procedure of the study was explained. After the introduction participants were allowed to ask questions. Subsequently, the actual test was run. First, an emotion word appeared on the screen (e.g. *inspiration*). Participants were told to imagine that they were experiencing this emotion ("imagine that you're experiencing the emotion *inspiration*"). Subsequently, three animations were presented in a random order. The three animations (i.e. animation A, B and C) were shown three times in the following sequence: (A – B – C); (A – B – C); (A – B – C). Next, the following instruction appeared on the screen: "which of these three animations best expresses *inspiration*?" Participants were given one minute to record their answer in the

**Table 4-1** Fourteen emotion words in English, Dutch, Finnish, and Japanese, as applied in Study 6.

English	Dutch	Finnish	Japanese
Disgust	Walging	Kuvotus	気持ち悪い
Indignation	Verontwaardiging	Pahastuneisuus	憤慨する
Contempt	Minachting	Halveksunta	軽蔑する
Unpleasant surprise	Onaangename verrassing	Pelästyneisyys	驚く(否定的に)
Dissatisfaction	Ontevredenheid	Tyytymättömyys	不満足な
Disappointment	Teleurstelling	Pettymys	失望する
Boredom	Verveling	Pitkästyneisyys	退屈に感じる
Inspired	Inspiratie	Inspiroituneisuus	ひらめく
Desire	Verlangen	Kaipaus	欲しくなる
Pleasant surprise	Aangename verrassing	Iloinen yllätys	驚く(肯定的に)
Amusement	Amusement	Huvittuneisuus	楽しい
Admiration	Bewondering	Ihailu	賞賛に値する
Satisfaction	Tevredenheid	Tyytyväisyys	評価出来る
Fascination	Geboeid	Kiehtovuus	魅せられる

booklet and then the next emotion word appeared on the screen. The order in which the emotion words were shown differed between participant groups. The re-test was performed in Delft four weeks after the first test, following the same procedures.

For each given emotion word two alternative animations were shown next to the animation that was designed to portray a particular emotion (i.e. the 'target animation'). These two alternatives were not chosen at random. Instead, the two animations most *similar* to the target animation were selected. This was intended to make the task as rigorous as possible. For example, participants were asked to report which of three animations best portrayed *disappointment*. In this particular example, it was more difficult to select the animation designed to portray *disappointment* from a set that also included animations portraying *dissatisfaction* and *indignation*, than from a set that included *pleasant surprise* and *fascination*.

The results of Study 1 (Section 2.2) were used to assemble sets of similar animations. In this study, emotions have been categorised on the basis of two dimensions: 'pleasantness' and 'activation.' Using these two dimensions, emotions were divided

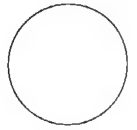
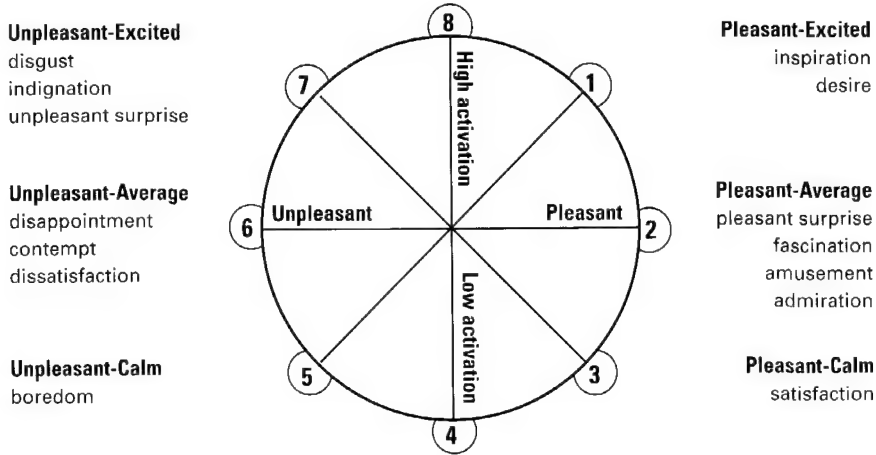


Figure 4-1 Fourteen PrEmo-6 emotions in eight categories.



over eight categories. Figure 4-1 shows the eight categories that resulted from Study 1 with the emotions that are portrayed by the PrEmo-6 animations.

Emotions within categories (e.g. *admiration* and *fascination*) are regarded as being more similar than emotions between categories (e.g. *fascination* and *disappointment*). Moreover, differences between emotions in adjoining categories are regarded as smaller than those between emotions in non-adjoining categories.

All sets of three animations were selected with the following guideline: as well as the target animation (e.g. *dissatisfaction*), each set included an animation that was randomly chosen from the same emotion category (e.g. *disappointment*) and one that was randomly chosen from a neighbouring category (e.g. *indignation*). As no alternative animation was available in the category of *boredom*, the two alternative animations accompanying this emotion were selected from Category 6. Similarly, for the emotion *satisfaction* two alternatives were selected randomly from Category 2.

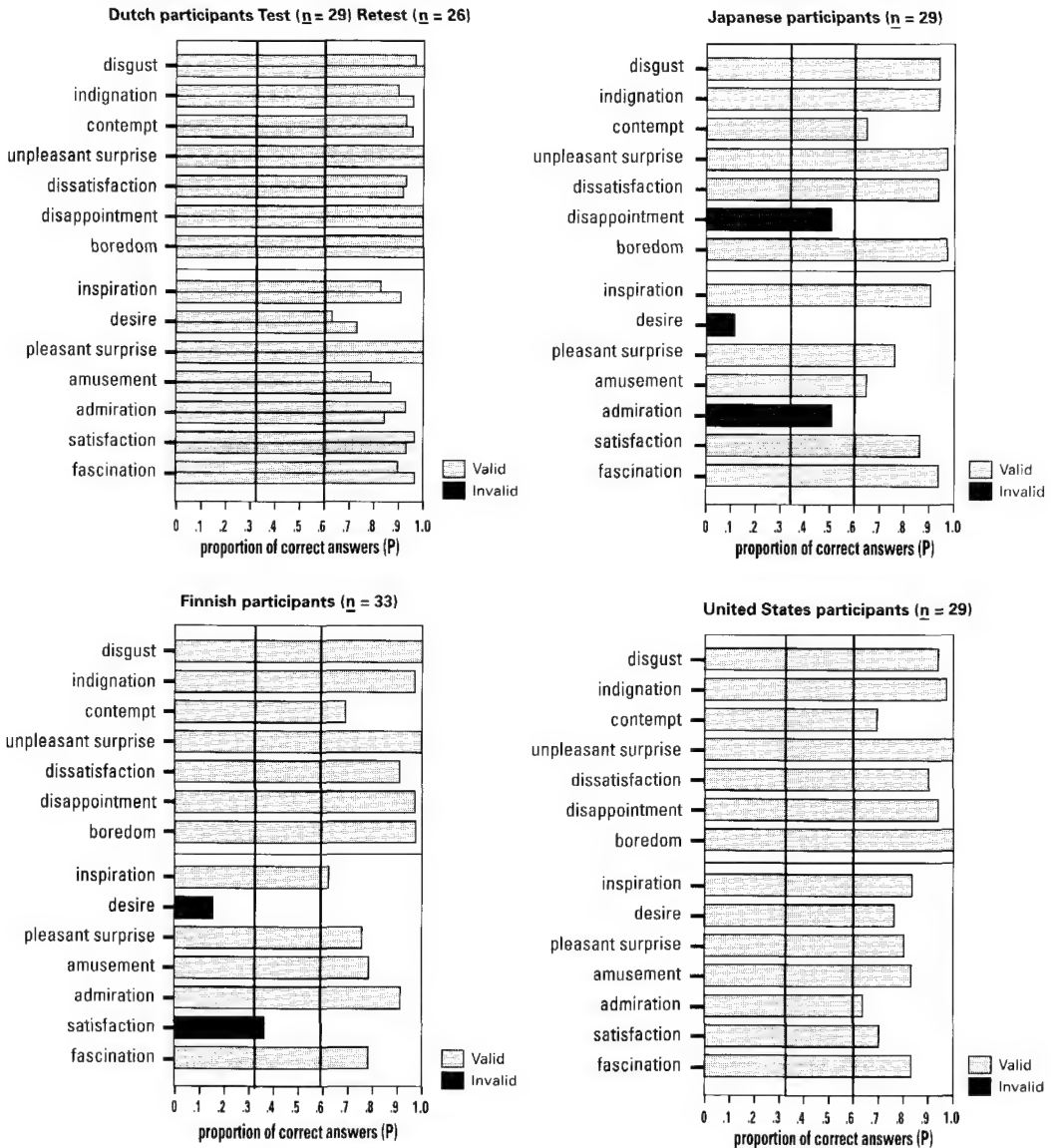
## Results

A participant ( emotion matrix was constructed in which each cell has a value of either 1 (the target animation was selected) or 0 (one of the two other animations was selected).

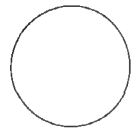
For each animation a proportion of correct answers (P) was computed, ranging from 0 (percentage of correct answers = 0%) to 1.0 (percentage of correct answers = 100%). In Figure 4-2 the proportion of correct answers (P) for each animation is depicted for the various countries. The graphs of the Dutch participants show P-values for both the test and the retest.



Figure 4-2 Validity of the fourteen animations in four countries.



The graphs show the proportion of correct answers (P) for 14 animated puppets in four countries (The Netherlands, Japan, Finland, and the United States). The graphs of the Dutch participants show the test results (top bar) and the re-test results (bottom bar). The dotted line indicates chance level ( $= .33$ ); the black line indicates the validity criterion. Light grey bars indicate animated puppets that meet the criterion. Those that do not meet the criterion are shown in dark grey.



**Table 4-2** Re-translations of the emotion words referring to invalid *PrEmo-6* animations.

Initial word	Translation	Back-translation
Desire	欲しくなる	- Desirable - Desirable
	Kaipaus	- Melancholic longing - Longing for something lost
Admiration	賞賛に値する	- Praiseworthy - Honourable
Disappointment	失望する	- Disappointing - Disappointed
Satisfaction	Tyytyväisyys	- Appreciating - Approving

The validity of the animations was based on the following criterion: If  $P$  is significantly ( $p < .001$ ) higher than chance level ( $= .33$ ), an animation is considered valid.<sup>2</sup> Hence, an animation was considered valid if  $P > .60$  for the Dutch, Japanese and United States results, and  $P > .59$  for the Finnish results ( $p < .001$ ). The strict significance level (i.e.  $p < .001$ ) was applied because it is important that all slightly inaccurate animations are identified. Figure 4-2 shows that all animations are valid in The Netherlands and the United States. In the other two countries, some animations are not valid. In Japan the animations portraying *disappointment*, *desire* and *admiration* are invalid. Similarly, in Finland the animations portraying *desire* and *satisfaction* are not valid. The animation that portrays *desire* appears to be particularly inaccurate. In both Japan and Finland the proportion of correct answers for this animation was well *below* chance level. Note that the proportion of correct answers for this animation was also relatively low in The Netherlands.

For each animation, a one-tailed  $t$ -test indicated no significant differences between the test and re-test results. In addition, a sign test was performed to inspect the within-participant consistency of responses (answers test-retest: correct-correct or incorrect-incorrect = consistent; correct-incorrect or incorrect-correct = inconsistent). For  $n = 26$ , the critical value  $C$  ( $p = .05$ ) = 7. For each animation the number of inconsistent answers was  $< 7$ , which indicated no significant within-participant differences between the test and re-test responses.

## Discussion

All animations were found to be valid in The Netherlands and the United States. In Finland and Japan, however, some animations were found to be invalid. There are



two possible explanations for this finding. The first is that the findings point to cultural differences in emotional expressions. Japanese people may not understand the animation portraying *desire* because Japanese people express *desire* differently from Dutch people. The alternative explanation is that the findings may have been caused by inaccurate translations. Emotion words are often difficult to translate (e.g. Russell, 1989). Therefore, it may be possible that the emotion words (see Table 4-1) that served as references in Study 6 are inaccurate. To assess if the translations might have been responsible for the lack of validity of some emotions, they were re-translated by two professional translators. The translators were told that the words described emotions evoked by product appearance.<sup>3</sup> Results are shown in Table 4-2.

The table indicates some translation inaccuracies that may have influenced the results. The Japanese word for *desire* was re-translated as 'desirable,' and the Japanese word for *disappointment* as 'disappointing.' Apparently, in these two cases the results cannot be attributed to translation difficulties. Thus, it can be concluded that the two animations representing these emotions are inaccurate in Japan. In all other cases, the re-translations indicate that the results may have been caused by inaccurate translations. In those cases, the validity of the animations remains inconclusive.

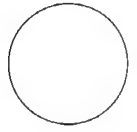
#### Exploring emotional expressions of invalid animations.

In order to be able to adjust (or redesign) the invalid animations, Japanese emotional expressions were explored. Japanese actors were instructed to express the emotions *admiration*, *desire* and *disappointment*. This exploration followed the same procedure as in Study 5 (Section 3.5). Six professional Japanese actors were asked to express the given emotions.

The results of this exploration indicated that the Japanese expression of *admiration* is similar to the Dutch expression of this emotion. This suggests that the lack of validity in Japan was not caused by an inaccurate animation but by an inaccurate translation. The Japanese actors' expressions of the emotions of *desire* and *disappointment* differed from those of the Dutch actors. Figure 4-3 shows some screen shots of the videotaped Japanese actors expressing *desire* and *disappointment*.

The Japanese expression of *disappointment* was, to a large degree, similar to the Dutch expression of this emotion. However, one clear difference could be observed. At the end of the expression, all Japanese actors looked away from the object of their disappointment; they avoided eye contact with the object (and looked either down or away). The Dutch actors did not show this 'looking away' behaviour.

The Japanese expression of *desire* was similar to the Dutch expression in terms of facial and postural dynamics (eyes open wide, mouth showing a broad smile, hands reaching forward to 'grab' the object of desire; see Figure 4.3). The vocal expression was, however, very different. Whereas the Dutch expressed *desire* with



**Figure 4-3 Japanese actors expressing disappointment and desire.**



*Two actresses expressing disappointment.  
Both actresses look away from the object of  
disappointment.*

*One actor and one actress expressing desire.  
The actress shows hand-movements similar to the PrEmo  
animation. The actor shows a facial expression similar  
to the PrEmo animation.*

an “aaaahhhh” sound, the Japanese expressed desire with a “hmmmmm” sound.

These results suggest that the lack of validity of the animations portraying *disappointment* and *desire* is the result of an intercultural difference in emotional expressions. The Japanese do not understand the emotions portrayed by these animations because Japanese people express these emotions differently. Although the differences are small, even small differences may have been large enough to cause confusion.

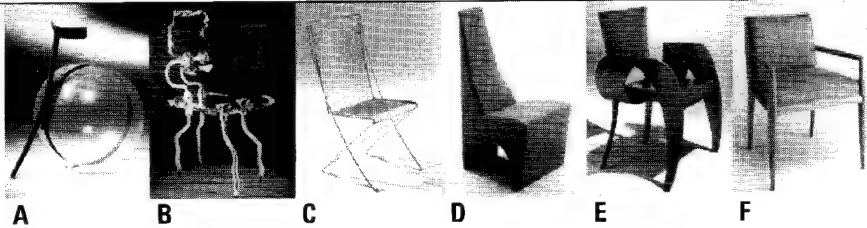
### General discussion

In Study 6 it was found that most of the PrEmo animations portray emotions accurately. People in The Netherlands and in the United States understand the portrayals of all the animations. People in Japan, however, do not understand the animations portraying *desire* and *disappointment*. A study done with Japanese actors indicated that these portrayal inaccuracies are caused by cultural differences in the way in which the emotions are expressed. People in Japan express *desire* and *disappointment* differently from people in The Netherlands. These differences in expression were found to be small. This illustrates that even small differences can lead to confusion. If in Japan it is considered inappropriate to look at the object of *disappointment*, then for Japanese people an animation which portrays *disappointment* without looking away is confusing. Although the animation’s general expression is accurate, this small difference will cause the animation to be invalid.

The explorative study with the Japanese actors indicated that it is probably possible to correct the animations that portray *desire* and *disappointment*. With a few small modifications, these portrayals can be understood in Japan without compromising their accuracy for Dutch people. This design step has not yet been taken but it will be done in the development of PrEmo-7, which is not discussed in this thesis.



Figure 4-4 Stimuli used in Study 7.



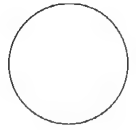
### 4.3 PrEmo-6 validation – Study 7

In the previous section, the validity and reliability of the 14 PrEmo-6 animations were evaluated. As PrEmo is used for self-reporting emotions elicited by product appearance, the second step was to investigate to what degree product emotions can be measured accurately with this instrument. In Study 7, emotions elicited by six chairs were measured. These emotions were measured twice: once with PrEmo-6 and once with a set of verbal scales that measure the same set of emotions as PrEmo-6. This study was designed to assess PrEmo-6's discriminant, convergent and face validity.

The aim of Study 7 is to assess three types of validity: the (1) discriminant, (2) convergent, and (3) face validity.

- (1) Discriminant validity. Can PrEmo-6 differentiate between products of different design on the basis of emotional responses elicited by these products? This question is related to PrEmo-6's *discriminant validity*, which was defined by Carmines and Zeller (1979) as the ability of the instrument to differentiate between stimuli.
- (2) Convergent validity. Are the results obtained with PrEmo-6 comparable to results obtained with a verbal instrument designed to measure the same 14 emotions? This question is related to the *convergent validity*. Convergent validity concerns the degree of agreement between different measurement instruments of the same construct (Carmines & Zeller, 1979). A high degree of agreement should be found between emotions measured with PrEmo-6 and emotions measured with a questionnaire which includes verbal scales of the same 14 emotions.
- (3) Face validity. Is PrEmo-6 more intuitive in use than verbal questionnaires and therefore more convenient for reporting emotional responses? This question is related to the *face validity*. A self-report instrument's face validity concerns the degree to which participants believe the instrument helps them to adequately report their response. Although subjective, face validity is important for the development of self-report instruments. When asked to provide feedback on a



**Table 4-3 Emotions measured by PrEmo-6.**

Unpleasant emotions	Pleasant emotions
Indignation	Desire
Contempt	Pleasant surprise
Disgust	Inspiration
Unpleasant surprise	Amusement
Dissatisfaction	Admiration
Disappointment	Satisfaction
Boredom	Fascination

measurement, participants should agree that the 14 emotions included allow them to express their responses to the product's appearance. Also, their feedback should support the claim that the animations make possible more intuitive and satisfying ratings than verbal alternatives.

## Method

### Participants

Participants ( $N = 30$ ; 15 female, 15 male) were members of the consumer panel of the Department of Industrial Design Engineering at Delft University of Technology. This panel is an a-select sample of inhabitants of Delft and the surrounding area (see Tan, 1995a). Participants were equally divided over age groups (ages ranged from 25 to 50). All participants were of Dutch nationality and had computer experience.

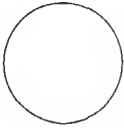
### Stimuli

The stimuli were six colour photos of chairs (see Figure 4-4). It was decided to use stimuli that differed only in appearance (as opposed to including different types of products) because PrEmo-6 has been specifically developed to measure emotional responses to product *appearance*. These particular chairs were selected because they had pronounced and expressive characteristics and could thus be expected to elicit measurable emotional responses.

### Apparatus and material

The experiment was conducted with PrEmo-6 on a computer and a paper questionnaire that contained a verbal instrument for measuring emotional responses. Both PrEmo-6 and the verbal instrument included the 14 emotions in Table 4-3.

With PrEmo-6, participants used a three-point scale to report their emotions (i.e. I do not feel the emotion expressed by this animation; I feel some of the emotion expressed by this animation; I do feel the emotion expressed by this animation). In the questionnaire, the 14 emotions were rated on the same three-point scale.

**Table 4-4 MANOVA results, PrEmo measurement.**

Unpleasant emotions		Pleasant emotions	
	<i>F</i> (5,21)		<i>F</i> (5,21)
Disgust	12.96**	Inspiration	6.44**
Indignation	6.26**	Desire	8.96**
Contempt	4.81*	P-surprise	13.81**
U-surprise	8.73**	Amusement	4.30**
Dissatisfaction	6.94**	Admiration	7.55**
Disappointment	1.84	Satisfaction	6.98**
Boredom	6.50**	Fascination	6.79**

Note: U-surprise = unpleasant surprise; P-surprise = pleasant surprise.

Wilks' Lambda. ( $p < .05$ ) = \*; ( $p < .01$ ) = \*\*

A second questionnaire asked some evaluative questions regarding the participants' opinion of the chairs, and concerning the use of PrEmo-6 and the verbal scales.

#### Procedure

Each participant performed the experiment individually. A written introduction was given to participants, explaining that the purpose of this experiment was to assess the emotions elicited by six chairs. They were told that the test ran automatically on a computer and were instructed to start the procedure when they were ready. A computer program then guided the participant through the procedure.

In the introduction, the procedure of the experiment was outlined, and the use of PrEmo-6 explained and practiced. Participants were informed that it was the chairs and not the participants that were being tested, and that they should feel free to give their opinions. After the introduction, participants were presented with an overview of all six chairs on the computer screen (for ten seconds).

The six chairs were presented in a randomised order to each participant. The design was balanced in such a way that half of the participants ( $n = 15$ ) first rated the chairs using PrEmo-6 and then, in a different random order, using the questionnaire. The other half of the participants first used the questionnaire and next PrEmo-6 to rate the chairs. Participants were told to take as much time as they needed, but to avoid thinking too much about their responses because we were interested in their spontaneous emotional reactions. After finishing the rating task participants filled out the evaluation questionnaire.

#### Results

PrEmo-6 responses of four participants were not recorded because of technical difficulties. Results and analyses are reported in correspondence with the three major research questions.

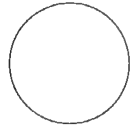


Table 4-5 Differences between mean chair scores on the 14 emotions, as measured with PrEmo.

Emotion	Pairwise comparisons (mean chair design 1 – mean chair design 2)														
	A-B	A-C	A-D	A-E	A-F	B-C	B-D	B-E	B-F	C-D	C-E	C-F	D-E	D-F	E-F
Disgust	-.39	<b>.69</b>	.42	<b>.73</b>	.35	<b>1.08</b>	<b>.81</b>	<b>1.12</b>	.73	-.27	.04	-.35	.31	-.08	-.39
Indignation	-.46	.35	.27	.27	.31	<b>.81</b>	<b>.73</b>	<b>.73</b>	<b>.77</b>	-.08	-.08	-.04	.00	.04	.04
Contempt	-.27	.15	.04	.23	-.15	<b>.42</b>	.31	<b>.50</b>	.12	-.12	.08	-.31	.19	-.19	-.39
U-surprise	-.15	.39	<b>.58</b>	.15	.46	.54	<b>.73</b>	.31	.62	.19	-.23	.08	<b>-.42</b>	-.12	.31
Dissatisfaction	-.39	.69	.42	.54	.12	<b>1.02</b>	<b>.81</b>	<b>.92</b>	.50	-.27	-.15	-.58	.12	-.31	-.42
Disappointment	-.23	.19	.15	.27	.04	.42	.39	.50	.27	-.04	.07	-.15	.12	-.12	-.23
Boredom	-.27	-.12	-.04	-.04	<b>-1.0</b>	.15	.23	.23	<b>-.73</b>	.08	.08	<b>-.89</b>	.00	<b>-.96</b>	<b>-.96</b>
Inspiration	.27	-.12	-.04	-.42	.46	-.39	-.31	<b>-.69</b>	.19	-.08	-.31	<b>.58</b>	-.39	<b>.50</b>	<b>.89</b>
Desire	.35	-.31	-.04	-.31	.35	<b>-.65</b>	-.39	<b>-.65</b>	.00	.27	.00	<b>.65</b>	-.27	.39	<b>.65</b>
P-surprise	.39	-.04	.27	-.39	<b>.77</b>	-.42	-.16	<b>-.77</b>	.39	.31	-.35	<b>.81</b>	<b>-.65</b>	<b>.50</b>	<b>1.15</b>
Amusement	.27	<b>.65</b>	.54	.19	<b>.77</b>	.39	.27	-.08	.50	-.12	-.46	.12	-.37	.23	<b>.58</b>
Admiration	.15	-.19	-.08	-.42	.42	-.35	-.23	<b>-.58</b>	.27	.12	-.23	.62	-.35	.50	<b>.85</b>
Satisfaction	.23	-.58	-.39	-.39	-.04	<b>-.81</b>	<b>-.62</b>	<b>-.62</b>	-.27	.19	.19	.54	.00	.35	.35
Fascination	-.08	-.39	-.15	<b>-.73</b>	.15	-.31	-.08	<b>-.65</b>	.23	.23	-.35	.54	-.58	.31	<b>.89</b>

Note: U-surprise = Unpleasant surprise; P-surprise = Pleasant surprise. Two-tailed t-test ( $N = 26$ ). Adjustment for multiple comparisons: Bonferroni. Significant mean differences ( $p < .05$ ; adjusted  $p < .003$ ) are shown in bold.

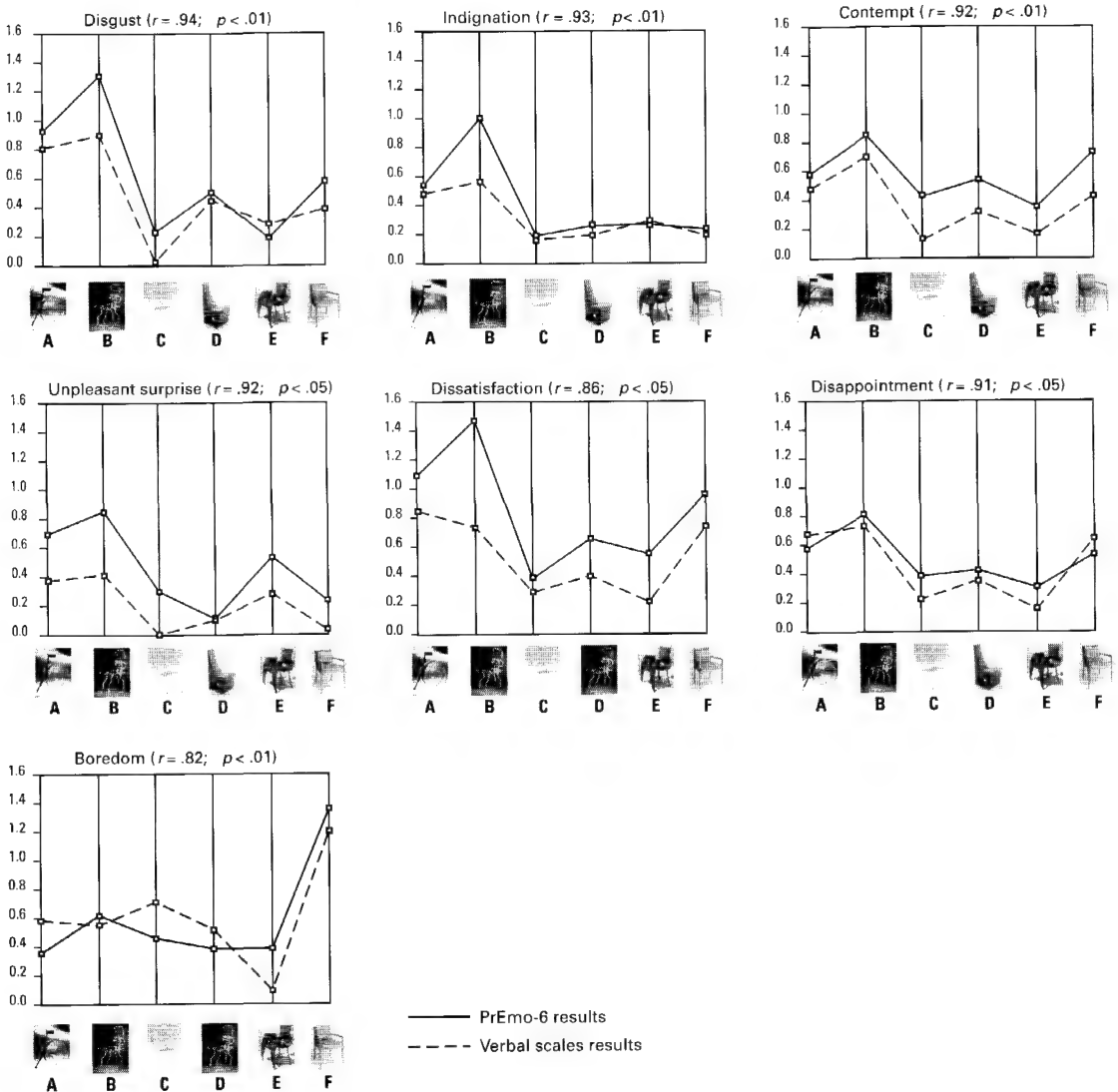
### (1) Discriminant validity

To discover if the emotions measured with PrEmo-6 differentiated between the chair designs, for each emotion a repeated measures MANOVA was performed, with Chair (six levels) as within-participant factor, and the measured emotion as dependent variable. The  $F$  values that resulted from these analyses are shown in Table 4-4. A significant effect ( $F(5,21)$ ,  $p < .05$ ) was found for all emotions except for *disappointment*. This indicates that the other 13 emotions differentiated between the chairs.

To examine the differences in emotions elicited by the six chair designs in more detail, the effects for the chair designs were analysed in pairs with a post-hoc test (see Table 4-5). The table shows the differences between the means for each pair of chair models. The table indicates that the emotions elicited by some chairs differ more than the emotions elicited by other designs. Of all pairs, chairs B and E differ on the highest number of emotions (10 of 14). Chairs E and F differ on seven emotions. Compared to F, E has significantly higher scores on all pleasant emotions except *satisfaction*. No significant differences were found between chairs A and B, C and D, or C and E. Chair D differs from E only in the sense that it elicits less *surprise* (both pleasant and unpleasant). Chair F elicits significantly more *boredom* than all the other chairs.

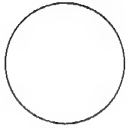


Figure 4-5 Mean scores for PrEmo-6 and verbal scales; unpleasant emotions.



## (2) Convergent validity

The mean scores of the chairs for each emotion, obtained both with PrEmo-6 and the verbal scales, are presented in Figures 4-5 and 4-6. Both figures show a high degree of agreement between the verbal and PrEmo-6 scores.



Correlations between the PrEmo-6 scores and the scale scores are presented in Table 4-6. The table shows that the correlations between emotion scores measured with the two methods are high ( $r$  varies from .72 to .99) and all but one (i.e. *amusement*) are significant ( $p < .05$ ). Note that Figures 4-5 and 4-6 indicate that for some emotions the scores obtained with PrEmo-6 are slightly higher than those obtained with the verbal scales (e.g. *contempt* and *desire*).

For each emotion a repeated measures MANOVA was performed, to examine interaction effects between chair model and method. These analyses have been performed with two 'within' factors: Method (2 levels) and Chair (six levels). None of these 15 analyses found a significant interaction effect between Chair and Method. In agreement with the high correlations, these findings indicate that the participants did not respond differently to each of the chairs as a result of the measurement instrument applied.

### (3) Face validity

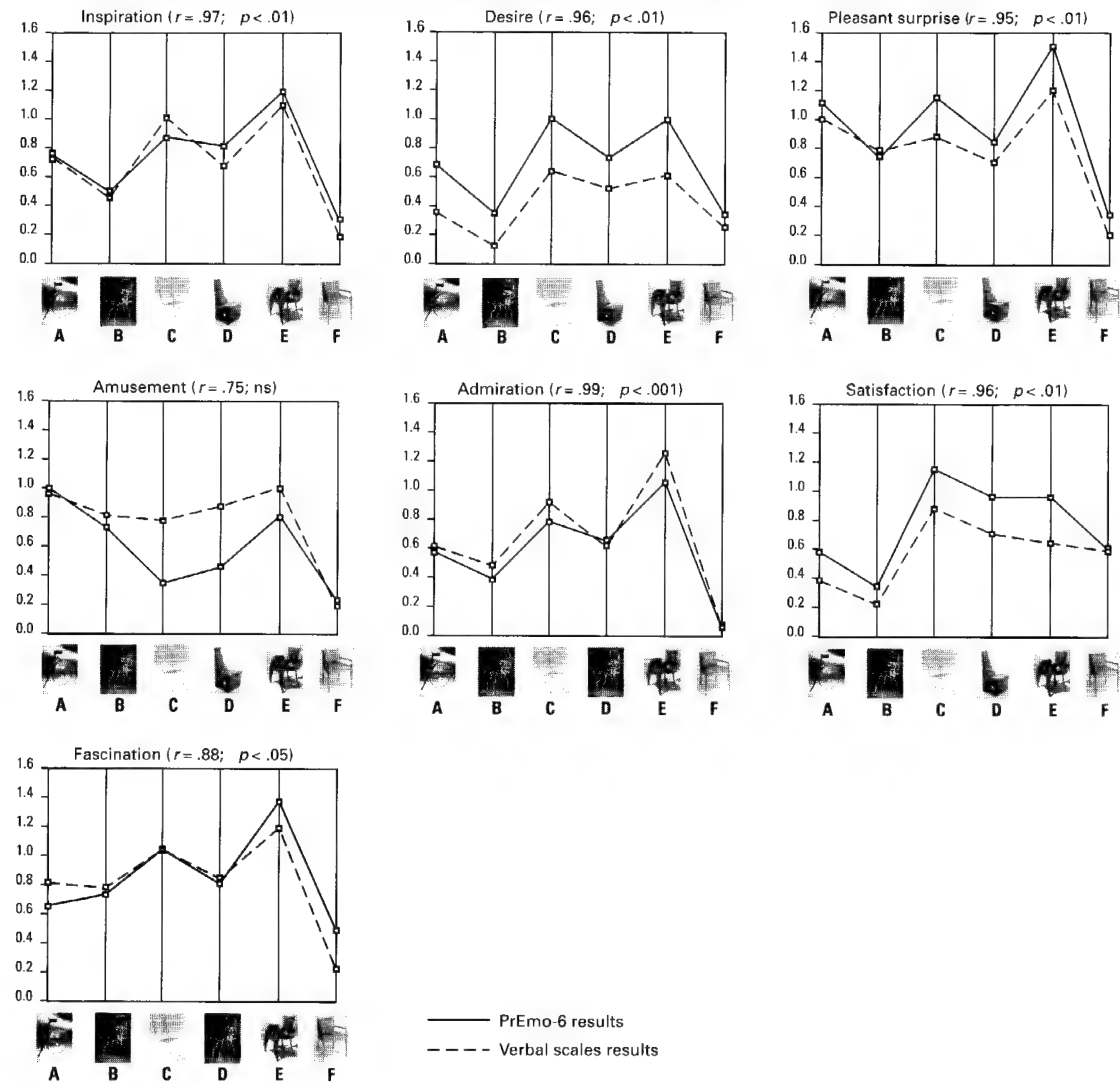
Two questions in the evaluation questionnaire related to PrEmo-6's face validity. The first question involved the set of emotions included in PrEmo. Participants were asked if, in their opinion, the 14 emotions provided an adequate vocabulary for reporting their emotional responses to the chair designs. They were asked to report both missing and redundant emotions. Four of the 30 participants reported that they missed the emotion *indifference*. This was the only emotion that was reported missing. Secondly, participants were asked to report which of the two instruments they preferred: PrEmo-6 or the verbal scales. They were asked to explain their choice. Of the 30 participants, 25 reported that they preferred PrEmo-6 to the verbal scales. Three participants preferred the verbal scales and two expressed no preference. Though differing in their reasoning, all the participants who preferred PrEmo-6 agreed that the animations "help to relate the emotions to myself." The remarks of one of the participants exemplifies this:

*"To judge emotion words is difficult, because I have to evoke the particular emotion and subsequently compare this experience with the emotion that is evoked by the chair (e.g. the emotion 'admire': first enter into this emotion, subsequently judge whether or not this emotion is evoked by the chair, and finally judge the degree to which this emotion is evoked). The puppets provide a better image of the emotion (in such a way that you do not have to live the emotion) and that makes the emotion much more easy to judge."*

Or, as another participant puts it: "As I see it, during the assessment I become the puppet." The three participants who preferred the verbal scales commented that the animations suffered from a 'lack of clarity.' They felt insecure about their rating



Figure 4-6 Mean scores for PrEmo-6 and verbal scales; pleasant emotions.



because they were not sure about the emotion expressed by the animations. Finally, 24 participants (including the three participants who preferred the use of the verbal scales) reported that they found the PrEmo-6 task much more enjoyable than the verbal scales task.

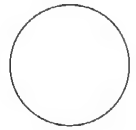


Table 4-6 Correlations between PrEmo-6 scores and verbal ratings.

Unpleasant emotions	Pleasant emotions	
	r	r
Disgust	.94**	Inspiration .97**
Indignation	.93**	Desire .96**
Contempt	.92**	P-surprise .95**
U-surprise	.92*	Amusement .75
Dissatisfaction	.86*	Admiration .99**
Disappointment	.91*	Satisfaction .96**
Boredom	.82**	Fascination .88*

Note: U-surprise = unpleasant surprise; P-surprise = pleasant surprise.

( $p < .05$ ) = \*; ( $p < .01$ ) = \*\*

## Discussion

Study 7 demonstrated that PrEmo-6 enables the researcher to differentiate products on the basis of the users' emotional responses. The chairs were differentiated on 13 of the 14 PrEmo-6 emotions. Only for the emotion *disappointment* was no effect found. Note that from this finding it can not be concluded that this emotion can be removed from PrEmo-6. The lack of differentiation may have resulted from the 'product type.' Although those particular chairs did not elicit different levels of *disappointment*, in other studies this emotion showed an effect for products such as car models (see Desmet, Hekkert & Jacobs, 2000).

Participants agreed that the set of 14 animations was sufficient to adequately report their emotions. Only one 'emotion' was reported to be missing: 'indifference.' This is not an emotion but rather a 'non-emotional' state. Apparently, towards some chair designs participants wanted to report that they did not experience emotions. With PrEmo-6 this 'indifference' can be reported by rating all animations as: "this animation does not express what I feel." It was therefore decided not to include an additional animation expressing 'indifference.' Apart from indifference no other emotions were reported to be missing or redundant. This finding is indicative when compared with results from studies with previous PrEmo versions (which included more or other emotions). In application studies of PrEmo-4 and 5 (which included 18 emotions) participants often reported that they missed some emotions and that some animations were redundant (see Appendix 2). These findings support the belief that the set of 14 emotions measured by PrEmo-6 is sufficient for a satisfactory self-report of emotions elicited by product appearance.

An important starting-point for the development of PrEmo was the assumption that the animations make it possible to measure emotional responses at least as adequately as with verbal alternatives. The results obtained with PrEmo-6 show a



remarkably high agreement with those obtained using verbal rating scales. Based on these results, it was concluded that PrEmo-6 is satisfactory with respect to its convergent validity. Moreover, participants preferred using the animations to using words for expressing their emotional responses. The animations were found to be more intuitive in use and, also important, much more enjoyable. Therefore, on the basis of user-friendliness it was concluded that PrEmo-6 is more satisfactory than verbal alternatives.

In summary, it was concluded that PrEmo-6 is a valid instrument for measuring emotional responses elicited by product appearance. The unique strength of the instrument is that it combines two qualities; it measures distinct emotions and it can be used cross-culturally because it uses animations instead of words.

## Notes

- [1] Finland was chosen because it is a West European country with a language that has a different origin from the Dutch language (Uralic versus Indo-European). The United States was chosen to represent a western, non-European culture. Finally, Japan was chosen to represent a non-western culture.
- [2] The table below shows the chance level calculations that have been used in Study 6.

---

*Chance level is  $M = .33$ ;  $H_0: P < .33$*

*Assuming a standard normal distribution;  $z = 3.090$  ( $p < .001$ )*

---

<b>Japan</b>		$\sigma = \sqrt{\pi(1-\pi)/n}$	$= \sqrt{.33(1-.33)/29} = .08754$
<b>United States</b>	<u>N</u> = 29	$z = (p-\pi) / \sigma$	$= (p-.33)/.08754$
<b>The Netherlands</b>			$(p-.33)/.08754 = 3.090$
			$\Rightarrow P = .60$
<hr/>			
		$\sigma = \sqrt{\pi(1-\pi)/n}$	$= (.33(1-.33)/33 = .08206$
<b>Finland</b>	<u>N</u> = 33	$z = (p-\pi) / \sigma$	$= (p-.33)/.08206$
			$(p-.33)/.08206 = 3.090$
			$\Rightarrow P = .59$

---

- [3] Translators indicated that it is difficult to translate words, because each word has various alternative translations. It was found that the number of alternative translations is reduced when the context of use of the particular word (i.e. the context of product experience) is known.



# 5: Product emotion measurement instrument application



## 5.1 Introduction

The Product Emotion Measurement instrument was developed to measure emotions that are often elicited by product appearance. This self-report instrument includes 14 animated puppets, each portraying a distinct emotion. Instead of using words participants use these animations to report their emotions.

The previous two chapters reported the development and validation of this instrument. This chapter explores its cross-cultural application possibilities. In Study 7, PrEmo was used to measure emotions elicited by six chairs. It was found that the chairs differed with regard to the emotions they elicited and that PrEmo was able to measure the differences. However, these differences in emotional responses to the chairs were not explored further. To that end Study 8, which is reported in this chapter, was designed to explore emotional responses, as measured with PrEmo, in more detail. This study, in which emotions elicited by six car model were measured, had three major explorative goals:

- (1) Explore differences in emotional responses between products.

An essential feature of PrEmo is that it measures distinct emotions. The first aim of Study 8 was to explore if (and to what extent) these distinct emotions differentiated between the car models. As some cars are more alike in appearance than others, we expected to find that the differences in emotional responses between some car models were greater than between others. Moreover, as PrEmo enables us to measure mixed emotions, i.e. combinations of simultaneously experienced emotions, the possibility that PrEmo results could be used to define 'profiles of mixed emotions' for the different car models was explored.

- (2) Explore cultural differences in emotions elicited by products.

An important requirement that shaped PrEmo's development was that the tool should enable cross-cultural comparisons. The decision to use animations instead of words was based primarily on this requirement. Given the strong interest of Mitsubishi in the influence of culture on emotional responses to car design, it was decided to perform a between-culture study. In Study 8, emotional responses to the car models were measured, both in Japan and in The Netherlands.<sup>1</sup>

- (3) Explore the possibility to define participant 'affect-groups.'

It is characteristic of emotions (elicited by product appearance) that they are personal, and they can therefore differ from person to person. Whereas one person may feel *disgust* towards a Fiat Multipla, the same Fiat may *inspire* another. Hence, in focussing on mean results, interesting between-participant differences may not be noticed. The third aim of Study 8, therefore, was to explore whether 'affect-groups,' i.e. subgroups of participants with similar emotional responses, could be identified. In addition, the relationship between affect-group membership and



*Figure 5-1 Stimuli used in Study 8.*



**Car A (Audi A2)**



**Car C (Mazda Demio)**



**Car E (Toyota bB)**



**Car B (Fiat Multipla)**



**Car D (Opel Zafira)**



**Car F (Toyota Funcargo)**

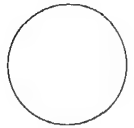
some demographic characteristics was examined, because such characteristics are often used to segment markets. For instance, products are often designed and marketed to appeal to young West European women or middle-aged North-American men, etcetera (e.g. Kotler, 1991). Given this interest, it was decided to explore relationships between affect-group membership, culture, gender and age.

Section 5.2 reports the method and a first impression of the results. Subsequently, Section 5.3, 5.4, and 5.5 report the results and the discussion of these results for each of the three major research goals. In the final section (5.6), PrEmo's application possibilities and limitations are discussed.

## **5.2 Intercultural PrEmo Application – Study 8**

This section first reports on the method of Study 8. Because the aim was to explore PrEmo's application possibilities six car models were used that were expected to differ with respect to the emotions they elicit. It was also expected that some cross-cultural differences in reported emotional responses would be found. As well as the study's method, a graphical representation of the results (i.e. a 'product & emotion space') is reported, which provides a general impression of the between-car and between-culture differences. In the next sections, the impressions drawn from that product & emotion space are reported and discussed in more detail.

In Study 8, emotions elicited by the six car models in Figure 5-1 were measured. Given the explorative nature of the experiment, no hypotheses had been defined beforehand. Nevertheless, one expectation regarding cultural differences was proposed on the basis of 'familiarity' with the car models. At the time of the experiment the Dutch participants were not familiar with Cars E and F, because these two car

**Table 5-1 Emotions measured in Study 8.**

Unpleasant emotions	Pleasant emotions	Unpleasant emotions	Pleasant emotions
Indignation	Pleasant surprise	Unpleasant surprise	Admiration
Contempt	Inspiration	Dissatisfaction	Satisfaction
Disgust	Amusement	Boredom	Fascination

models had not been introduced to the Dutch market. For similar reasons, the Japanese participants were not familiar with Cars A and B. It was therefore anticipated that the smallest between-culture differences in responses would be found with car models C and D. It was also anticipated that emotional responses would be related to the age and gender of the participants (e.g. women experience different emotions from men, and young people experience different emotions from old people).

## Method

### Participants

The participants ( $N = 69$ ) were inhabitants of Delft (The Netherlands;  $n = 37$ ) and Tokyo (Japan;  $n = 32$ ). Participants were matched on gender and age (20-60 years old). Dutch participants were members of the consumer panel of the Department of Industrial Design Engineering at Delft University of Technology. This panel is a select sample of inhabitants of Delft and the surrounding area (see Tan, 1995a). Japanese participants were recruited by a recruitment agency in Tokyo. At the time of the experiment all participants owned a car, with the exception of two Japanese who had owned one recently. All respondents were paid for their participation.

### Stimuli

The stimuli were colour photos of the six car models in Figure 5-1. These stimuli were selected because Mitsubishi Motor R&D recommended them as relevant to their research interests. The car model brands were masked.

### Material

The experiment was conducted using PrEmo on a computer, and a paper questionnaire. The questionnaire contained questions regarding age and gender. In Study 6, two PrEmo animated puppets, portraying *disappointment* and *desire*, were found to be invalid because Japanese participants did not understand the portrayals. Therefore, in Study 8, the results measured with these two puppets are not reported.<sup>2</sup> Measured (and reported) emotions are depicted in Table 5-1. Using PrEmo, participants reported each emotion for each stimulus on a three-point scale (i.e. "I do not feel this emotion" = 0; "I feel some of this emotion" = 1; "I do feel this emotion" = 2).



### Procedure

The study with the Japanese participants was completed at the Mitsubishi design studio in Tama, Tokyo in April 2000. Two months later, the study with the Dutch participants was completed at Delft University of Technology. The experiments were conducted on an individual basis. In Japan the written instructions were in Japanese and the oral instructions in English with a simultaneous translation into Japanese by an interpreter. In The Netherlands, both the written and the oral instructions were in Dutch.

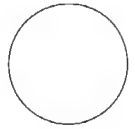
Participants were first given an introduction which explained that the purpose of this experiment was to assess the emotions elicited by six car models. They were told that the test ran automatically on a computer, and were instructed to start the procedure when they were ready. Subsequently, the computer explained the task and carried out an exercise in the use of PrEmo. Participants who were not familiar with the use of a computer were given personal supervision.

After the introduction and the exercise, participants were presented with an overview of all six car models on the computer screen (for 10 seconds). The six models were then presented in random order. After looking at a car model, participants were asked to report their emotional response(s) to that particular model. They were told that they could take as much time as they needed, but asked to avoid too much reflection because we were interested in their spontaneous emotional response. When they had finished rating all six models they filled out the paper questionnaire.

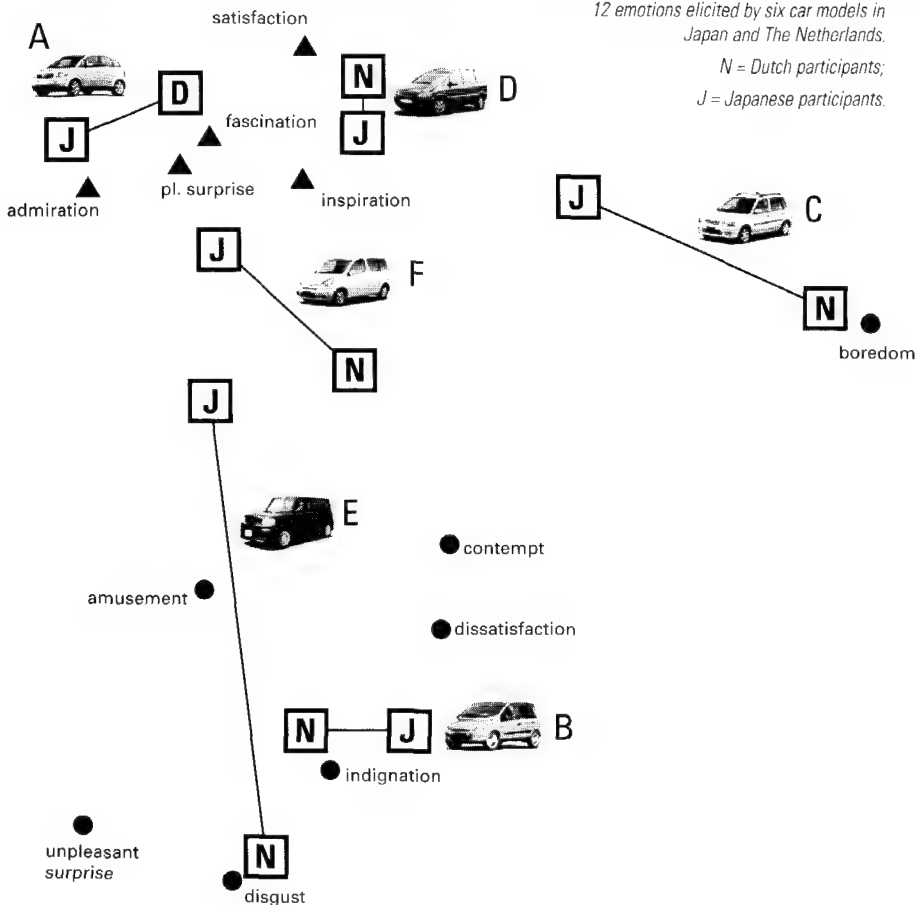
### Results

In order to obtain a graphical representation of the results a correspondence analysis was performed with three factors: Emotion (12 levels), Car (6 levels), and Culture (2 levels).<sup>3</sup> The Emotion levels represent the 12 emotions measured by PrEmo, the Car levels represent the six car models, and the Culture levels represent the Japanese and the Dutch participants. The analysis resulted in solutions in one to five dimensions. To determine the appropriate number of dimensions the explained inertia was examined. The total explained inertia by the six car models was .20 ( $\chi^2$  of the total inertia (187) = 754.21,  $p < .01$ ). The first dimension accounted for 76.6 percent of the total inertia, and the second for 14.7 percent. As a third dimension added only 3.6 percent, it was decided to choose the two-dimensional solution. Figure 5-2 shows the resulting 'product & emotion space.'

This product & emotion space visualises the associations between the car models and the reported emotional responses. Pleasant emotions are labelled with a triangle and unpleasant with a circle. The results of the Japanese participants are indicated with a 'J,' and those of the Dutch with an 'N.' The distances between the car models reflect the relationships between these models (with similar models plotted close to each other). Similarly, the distances between the car models and the emotions reflect



**Figure 5-2 Product & Emotion space.**



the relationship between them. This means that car models that are plotted close to each other elicited similar emotions, whereas those plotted at a distance from each other elicited different emotions. Cars A and D, for example, elicited similar emotions, whereas Cars A and B elicited noticeably different emotions.

In the product & emotion space some effects catch the eye. First, the degree to which the responses of the Japanese and the Dutch participants differ (i.e. between-culture difference) varies between the car models. For example, the between-culture difference for Car E is considerably bigger than for Car A. The expectation was that small between-culture differences would be found for Cars C and D. The space supports

**Table 5-2 Between-Car differences in reported emotional responses.**

Effect of Car on measured emotions F (5, 63)			
Unpleasant emotions		Pleasant emotions	
Disgust	22.46**	Inspiration	5.50**
Indignation	16.94**	Pleasant surprise	6.33**
Contempt	5.85**	Amusement	8.93**
Unpleasant surprise	24.39**	Admiration	6.04**
Dissatisfaction	12.07**	Satisfaction	7.84**
Boredom	9.55**	Fascination	8.52**

Note: Wilks' Lambda. Car = between-participant effect. ( $p < .01$ ) = \*\*.

the small difference that was expected for Car D. The differences for Car C, however, are bigger than was expected (i.e. bigger than the differences for Cars A and F).

Secondly, the degree to which car models differ from each other also varies. The difference between Cars A and D, for example, is smaller than the difference between Cars A and B. Moreover, some car models appear to have elicited mainly pleasant emotions (e.g. Car D), some mainly unpleasant (e.g. Car B), and some both pleasant and unpleasant (e.g. Car F).

The correspondence analysis is an exploratory technique, primarily intended to facilitate the interpretation of the data. Because it is not appropriate to draw conclusions from it, the observed effects will be examined in more detail in the following two sections. Between-car differences are reported and discussed in section 5.3. Section 5.4 reports on and discusses the differences between Dutch and Japanese responses. In addition, in Section 5.5 the relationship between participant characteristics and emotional responses are examined and discussed.

## 5.3 Between Car Model Differences

On the basis of the product & emotion space in Figure 5-2, the expectation was that the car models would differ with regard to all 12 measured emotions. Furthermore, it was expected that smaller differences would be found between cars A, D, and F, than between those three and the other car models. In this section, the exploration of between-car model differences in measured emotional responses is reported and discussed. Special attention was given to the occurrence of 'mixed emotions,' and an attempt was made to define 'emotion profiles,' i.e. graphical profiles that illustrate the between-car model differences.

To establish if the measured emotional responses differed over car models, for each emotion a one-way repeated measures MANOVA was performed, with Car (six levels)

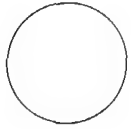


Table 5-3 Mean differences of emotional responses for each pair of car models.

Emotion	Pairwise comparisons (Mean Car model 1 – Mean Car model 2)														
	A-B	A-C	A-D	A-E	A-F	B-C	B-D	B-E	B-F	C-D	C-E	C-F	D-E	D-F	E-F
Disgust	<b>-.97</b>	-.03	.07	<b>-.99</b>	-.14	<b>.94</b>	<b>1.04</b>	-.01	<b>.83</b>	.10	<b>-.96</b>	-.12	<b>-1.06</b>	-.22	<b>.84</b>
Indignation	<b>-.83</b>	-.10	.06	<b>-.74</b>	-.16	<b>.72</b>	<b>.88</b>	.09	<b>.67</b>	.16	<b>-.64</b>	-.06	<b>-.80</b>	-.22	<b>.58</b>
Contempt	<b>-.61</b>	-.13	-.09	-.32	-.20	<b>.48</b>	<b>.52</b>	.29	<b>.41</b>	.04	-.19	-.07	-.23	-.12	.12
U-surprise	<b>-.84</b>	.25	.19	<b>-.70</b>	-.06	<b>1.09</b>	<b>1.03</b>	.14	<b>.78</b>	-.06	<b>-.94</b>	-.30	<b>-.88</b>	-.25	<b>.64</b>
Dissatisfaction	<b>-.93</b>	-.26	-.12	<b>-.78</b>	-.26	<b>.67</b>	<b>.81</b>	.14	<b>.67</b>	.14	<b>-.52</b>	.00	<b>-.67</b>	-.14	<b>.52</b>
Boredom	-.29	<b>-.71</b>	-.26	-.17	-.17	<b>-.42</b>	.03	.12	.12	<b>.45</b>	<b>.54</b>	<b>.54</b>	.09	.09	.00
Inspiration	<b>.54</b>	.36	.09	<b>.49</b>	.12	-.17	<b>-.45</b>	-.04	<b>-.42</b>	-.28	.13	-.25	<b>.41</b>	.03	-.38
P-surprise	<b>.57</b>	<b>.58</b>	.25	<b>.45</b>	.32	.01	-.32	-.12	-.25	-.33	-.13	-.26	.20	.07	-.13
Amusement	<b>-.67</b>	.17	.13	-.29	-.13	<b>.84</b>	<b>.80</b>	<b>.38</b>	<b>.54</b>	-.04	<b>-.46</b>	-.30	<b>-.42</b>	-.26	.16
Admiration	<b>.43</b>	<b>.43</b>	.14	.23	.19	.00	-.29	-.20	-.25	-.29	-.20	-.25	.09	.04	-.04
Satisfaction	<b>.75</b>	.32	.14	<b>.52</b>	.32	<b>-.43</b>	<b>-.61</b>	-.23	<b>-.43</b>	-.17	.20	.00	.38	.17	-.20
Fascination	<b>.59</b>	<b>.54</b>	.25	<b>.54</b>	.39	-.06	-.35	-.06	-.20	-.29	.00	-.14	.29	.14	-.14

Note: U-surprise = unpleasant surprise; P-surprise = pleasant surprise. Adjustment for multiple comparisons: Bonferroni. Significant Mean differences ( $p < .05$ ) are indicated with bold type.

as within factor and the emotion as dependent variable. The results of these analyses are shown in Table 5-2.

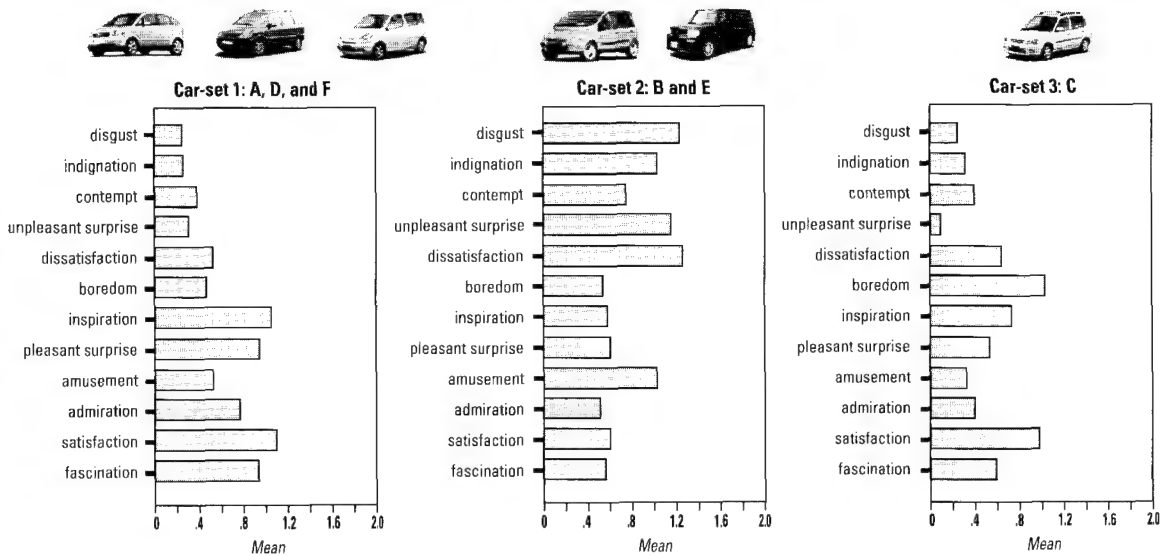
A significant Car effect ( $p < .01$ ) was found for all 12 emotions. This confirmed the expectation that the car models differentiate on all 12 measured emotions. Note that the F values of *unpleasant surprise*, *disgust*, *indignation* and *dissatisfaction* are higher than those of the pleasant emotions. Apparently, the car models differentiate more on these unpleasant emotions.

The product & emotion space in Figure 5-2 indicated that some car models differed more from each other than other models. A post hoc test was performed to investigate the degree to which the models differed from one another with respect to each measured emotion. In this test, the mean response ratings (on each emotion separately) were tested for the car models in pairs. The results of this analysis are shown in Table 5-3.

Each column in the table represents a pair of car models. The values in the table cells represent the differences between the mean ratings for each pair (e.g. the mean *disgust* rating for Car B was .97 higher than for Car A). The table supports the findings suggested by the product & emotion space. None of the differences between the responses to Cars A, D and F were significant, which indicates that those three car models elicited similar emotions. Also, Cars B and E elicited similar emotions (though Car B elicited significantly more *amusement* than Car E). Cars A and B, on



Figure 5-3 Emotion profiles of three car-sets.



the other hand, differentiated on most (11 of 12) emotions. The only emotion on which the car models did not show a significant difference was *boredom*.

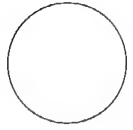
### Emotion profiles

On the basis of the results of the post hoc test, three car-sets were established: Car-set 1: Cars A, D, F; Car-set 2: Cars B and E; Car-set 3: Car C. Figure 5-3 shows graphical 'emotion profiles' of these three sets, which visualise the mean reported responses.

The figure shows that the car models elicited mixed emotions. The cars in sets 2 and 3 elicited both pleasant and unpleasant emotions, whereas the cars in set 1 elicited mainly pleasant emotions. The models in sets 2 and 3 did not score high on all pleasant and low on all unpleasant emotions, nor low on all pleasant and high on all unpleasant emotions. This illustrates the value of measuring distinct emotions as opposed to measuring general dimensions of emotions. These 'mixed emotions' cannot be captured with instruments that measure dimensions.<sup>4</sup>

The cars of Car-set 1 elicited (as compared to the other cars) mainly *inspiration* and *satisfaction*. On average these car models generated very low scores for unpleasant emotions. The car models in Car-set 2 elicited strong unpleasant emotions, such as *disgust*, *dissatisfaction* and *unpleasant surprise*. At the same time, they also elicited a high level of *amusement*. Apparently, these cars are disgusting





and amusing at the same time. Although to a lesser degree than the unpleasant emotions, these car models also elicited pleasant emotions such as *admiration* and *pleasant surprise*. Car set 3 elicited a high level of *boredom* and a high level of *satisfaction*. Apparently, this model is both boring and satisfying. In addition, it evoked *inspiration* and *dissatisfaction*. These responses appear contradictory (i.e. *satisfaction* versus *dissatisfaction*, and *boredom* versus *inspiration*). This may point to between-participant differences. Participants may have differed with respect to their reported responses. For instance, there may be one participant sub-group who was satisfied and inspired while another was bored and dissatisfied. These between-participant differences are explored in the next two sections.

## 5.4 Cross-Cultural Differences

In the product & emotion space (Figure 5-2), two cross-cultural effects can be observed. First, the degree to which the emotional responses of the cultures differ depends on the car model. The space indicates that cultural differences are greatest for Cars E and C. Cars A, B and D, on the other hand, appear to have elicited similar emotions in Japan and in The Netherlands. Secondly, the product & emotion space indicates that the Japanese experienced generally higher ratings on pleasant emotions than the Dutch. The three car models which showed the largest cultural differences elicited more pleasant emotions in Japan than in The Netherlands. In this section, these between-culture differences in emotional responses are investigated and discussed in depth.

For each emotion the relationship between culture and emotional response was analysed, using a two-way repeated measures MANOVA, with Car (six levels) as within-participants factor, Culture (two levels) as between-participant factor, and the emotion as dependent variable. The results of these analyses are shown in Table 5-4.

The table shows main effects for Culture (second column), Car x Culture interactions (third column), and post hoc tests of Culture effects for each car model (column 4 to 9). First, the analyses showed main effects for Culture on *admiration*, *satisfaction* and *fascination* responses ( $p < .01$ ). This indicates that (regardless of the car model) there were cultural differences between the ratings on these emotions. More specifically, Japanese participants produced higher mean ratings on each of these three emotions (i.e. *admiration*, M-Japanese = 1.80; M-Dutch = 1.43; *satisfaction*, M-Japanese = 2.03; M-Dutch = 1.74; *fascination*, M-Japanese = 1.92; M-Dutch = 1.57). Thus, in general, the Japanese were more fascinated, satisfied and admiring than the Dutch participants.

Secondly, for six emotions the analyses showed significant Car x Culture interaction effects. An interaction effect for a particular emotion indicates that the Culture effect depends on which car is being considered. Interaction effects were found for



**Table 5-4 Between-culture differences.**

Emotions	Main effect	Interaction	Culture effect on each car model F (1, 67)					
	F (1,67) Culture	F (5,63) Car x Culture	A	B	C	D	E	F
Disgust	1.13	<b>3.4**</b>	2.10	.33	.21	.50	<b>11.87**</b>	1.12
Indignation	.06	2.10	.24	<b>4.23*</b>	.12	.51	3.32	.00
Contempt	.10	.88	.41	3.00	.37	.00	.03	.00
U-surprise	.00	<b>3.39**</b>	3.52	.36	.04	.94	<b>8.25**</b>	.18
Dissatisfaction	2.10	<b>3.03*</b>	.82	.63	1.72	.36	<b>13.01**</b>	.41
Boredom	.19	.88	1.47	.61	1.33	1.05	.00	.10
Inspiration	1.20	.63	.05	.14	1.12	.03	.61	2.76
P-surprise	2.60	2.01	3.37	1.77	1.39	.01	<b>6.83**</b>	.79
Amusement	.82	<b>3.52*</b>	<b>4.15*</b>	.18	.36	.57	<b>5.26*</b>	3.21
Admiration	<b>15.75**</b>	<b>3.24*</b>	<b>15.01**</b>	.52	.60	1.25	<b>14.12**</b>	<b>6.83*</b>
Satisfaction	<b>9.78**</b>	<b>3.00*</b>	3.60	.15	<b>4.74*</b>	.15	<b>14.68**</b>	1.49
Fascination	<b>12.90**</b>	1.80	<b>8.12*</b>	.51	.64	2.73	<b>20.32**</b>	2.13

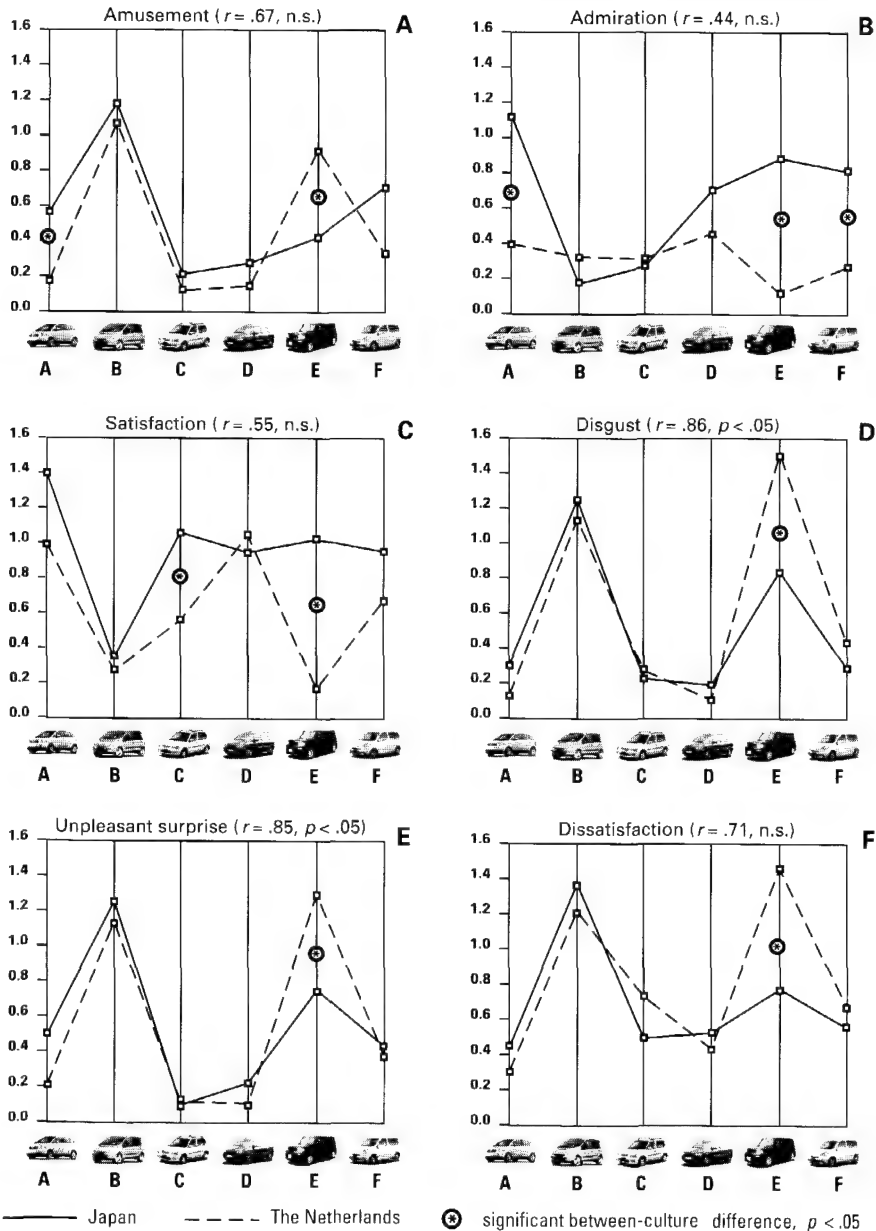
Note: U-surprise = unpleasant surprise; P-surprise = pleasant surprise. Car = within-participants effect; Culture = between-participant effect ( $\eta$ -Japan = 32;  $\eta$ -Netherlands = 37). Wilks' Lambda.  
F values: significant ( $p < .05$ ) = \*; significant ( $p < .01$ ) = \*\*. Significant F values are shown in bold type.

*disgust, unpleasant surprise, dissatisfaction, amusement, admiration and satisfaction.* To facilitate a more detailed examination of the interaction effects, Figures 5-4 shows graphic representations of the Japanese and Dutch mean responses to each car model for those emotions that showed a Car x Culture interaction.

Figure 5-4 depicts mean emotion ratings given to the car models by Japanese and Dutch participants. Significant between-culture differences ( $p < .05$ ) are indicated with a circled star. The figures illustrate the interaction effects. For example, Japanese participants were more amused by Car A than the Dutch participants, whereas the Dutch participants were more amused by Car E. The figure indicates that the interaction effects for the emotions *disgust, unpleasant surprise, and dissatisfaction* were mainly caused by Car E. With regard to these emotions, the responses for the two cultures differed only for this particular car model. The ratings for *amusement, admiration and satisfaction* do not only show between-culture differences for Car E but also for the other car models.

In the product & emotion space (Figure 5-2) it was found that the between-culture differences were most prominent for Car E. This indication was confirmed by the post hoc test results, which revealed significant differences between mean ratings for

Figure 5-4 Culture x Car interaction effects.





eight emotions. Car A also elicited significant mean differences between Japan and The Netherlands for three emotions.

It was expected that the smallest between-culture differences would be found in the responses to Cars C and D, because both the Japanese and Dutch participants were familiar with these models. The results of the post hoc test support this expectation (i.e. Car D did not show between-culture differences on any of the 12 emotions, and Car C on only one). However, considerable between-culture differences in responses towards the Cars B and F were also expected (because, at the time of the experiment, these were available only on the Dutch or on the Japanese market respectively). This expectation was not supported by the post hoc test. Like Car C, Cars B and F showed between-culture differences on only one or two emotions.

## 5.5 Affect-Groups

Looking at demographic consumer characteristics (e.g. gender, age, and culture) is one approach to defining target groups. Kotler (1991) also distinguishes a second approach, i.e. by looking at consumer responses to the particular product. Based on these responses (e.g. preferences), consumers are clustered in segments. Once these segments are formed, the researcher can investigate whether different consumer characteristics are associated with each segment. Given this approach, an interesting question is whether people can be clustered on the basis of their emotional responses. In this section such clusters, i.e. affect-groups, are reported and the relationship between cluster membership and demographic characteristics is investigated.

The first step in investigating between-participant differences was to examine the associations between gender, age and emotional responses. The effects of gender and age on the measured emotions were analysed with a three-way repeated measures MANOVA. The two within factors were Car (6 levels) and Emotion (12 levels), and the two between factors were Age (2 levels; 20-40, 41-60 years old) and Gender (2 levels) respectively. No significant main effect of age was found ( $F(3, 65) = .14$ , n.s.). This indicates that the overall emotional response of young participants did not differ from the responses of the older participants. Also, no significant interaction between Age and Car was found. Similarly, no significant main effect of Gender was found ( $F(1, 67) = .01$ , n.s.), indicating that the overall male emotional response did not differ from the female response. However, a significant Gender x Car interaction effect was found. To examine this effect in more detail, for each emotion a two-way repeated measures MANOVA was performed, with Car (six levels) as within-participants factor, Gender (2 levels) as between-participant factor, and the emotion as dependent variable. For Cars C and D significant Gender effects were found. The between-gender differences are visualised in Figure 5-5.

The figures show the mean emotion ratings given to Cars C and D by male and

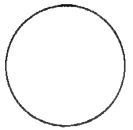
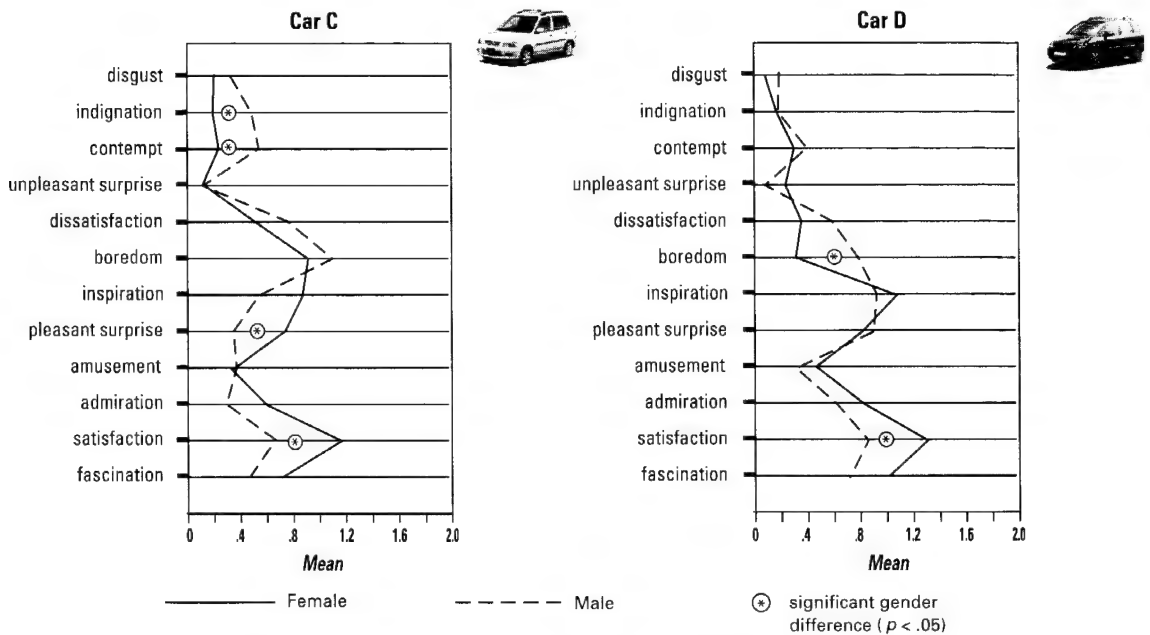


Figure 5-5 Relationship between gender and emotional responses.



female participants. A post hoc test indicated that the female participants experienced significantly more *pleasant surprise* and *satisfaction* and less *indignation* and *contempt* towards Car C than the male participants. Towards Car D their responses were less *bored* and more *satisfied*. For the other four car models no Gender effect was found. Apparently, male and female participants do not differ in their emotional responses as much as was expected.

### Affect-groups

The second step to investigate between-participant differences was to identify participant subgroups (i.e. 'affect-groups') that show small within-group and large between-group differences in emotional responses to the car models.

A k-means cluster analysis was performed to cluster (all 69) participants on the basis of their emotional responses. The first step in this analysis was to perform a hierarchical cluster analysis to investigate how many clusters should be identified. Based on the results of this analysis, it was decided to cluster the participants into three 'affect-groups.' The k-means analysis generated three affect-groups which differed in size:  $n$ -Group 1 = 32;  $n$ -Group 2 = 29;  $n$ -Group 3 = 8.

**Table 5-5 Affect-group composition as to age, gender and culture.**

Affect-group	Mean age	Japanese			Dutch			Japanese & Dutch		
		Female	Male	Total	Female	Male	Total	Female	Male	Total
1	42.4	7	5	12	12	9	21	19	14	$\underline{n} = 32$
2	37.8	6	6	12	5	11	16	11	17	$\underline{n} = 29$
3	38.0	3	5	8	-	-	-	3	5	$\underline{n} = 8$

#### Affect-group composition

Associations between affect-group membership and the participant characteristics of culture, age and gender were investigated. Table 5-5 shows the relationship between affect-group membership, age, gender and culture.

The table indicates that between-affect-group age differences are negligible. A chi-square analysis showed no age effects on affect-group membership ( $\chi^2(1) = 3.25$ , n.s.).<sup>5</sup> The table suggests some effect of gender on affect-group membership. However, the chi-square ( $\chi^2(1) = 3.19$ , n.s.) was not significant. Furthermore, the table indicates that the affect-groups differ in cultural composition. The largest affect-group ( $\underline{n} = 32$ ) consists of approximately one third Japanese and two thirds Dutch. The middle group ( $\underline{n} = 29$ ) is approximately equally divided over the cultures. The smallest group ( $\underline{n} = 8$ ) consists only of Japanese participants. This association between culture and affect-group membership is supported by a significant chi-square value ( $\chi^2(2) = 10.56$ ,  $p < .01$ ). In short, there is no relationship between affect-group membership, age and gender. There is, however, a relationship between culture and affect-group membership.

#### Affect-group responses

Graphical representations of the three groups' responses to each car model are depicted in Figure 5-6. This figure shows the mean reported emotional responses of participants in each affect-group.

The effect of affect-group membership on the emotional responses was analysed for each emotion with a two-way repeated measures MANOVA, with Car (6 levels) as a within factor, Group (3 levels) as between factor, and the emotion as dependent variable. Group membership has a main effect on all emotions except *unpleasant surprise* and *boredom*. There is a Car x Group interaction effect on all emotions except *amusement*. This indicates that the differences in responses on these 13 emotions between the affect-groups depend on the car model. The significant affect-group effects that were found for the separate car models are indicated in Figure 5-6. Each response that showed a significant between affect-group difference is indicated with three separate bars. The figure shows that the affect-groups differ most in their responses to Cars E, C and D respectively. They differ least in their responses to Car F. Note that the apparently contradictory responses indicated by the emotion profile

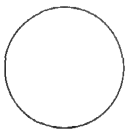
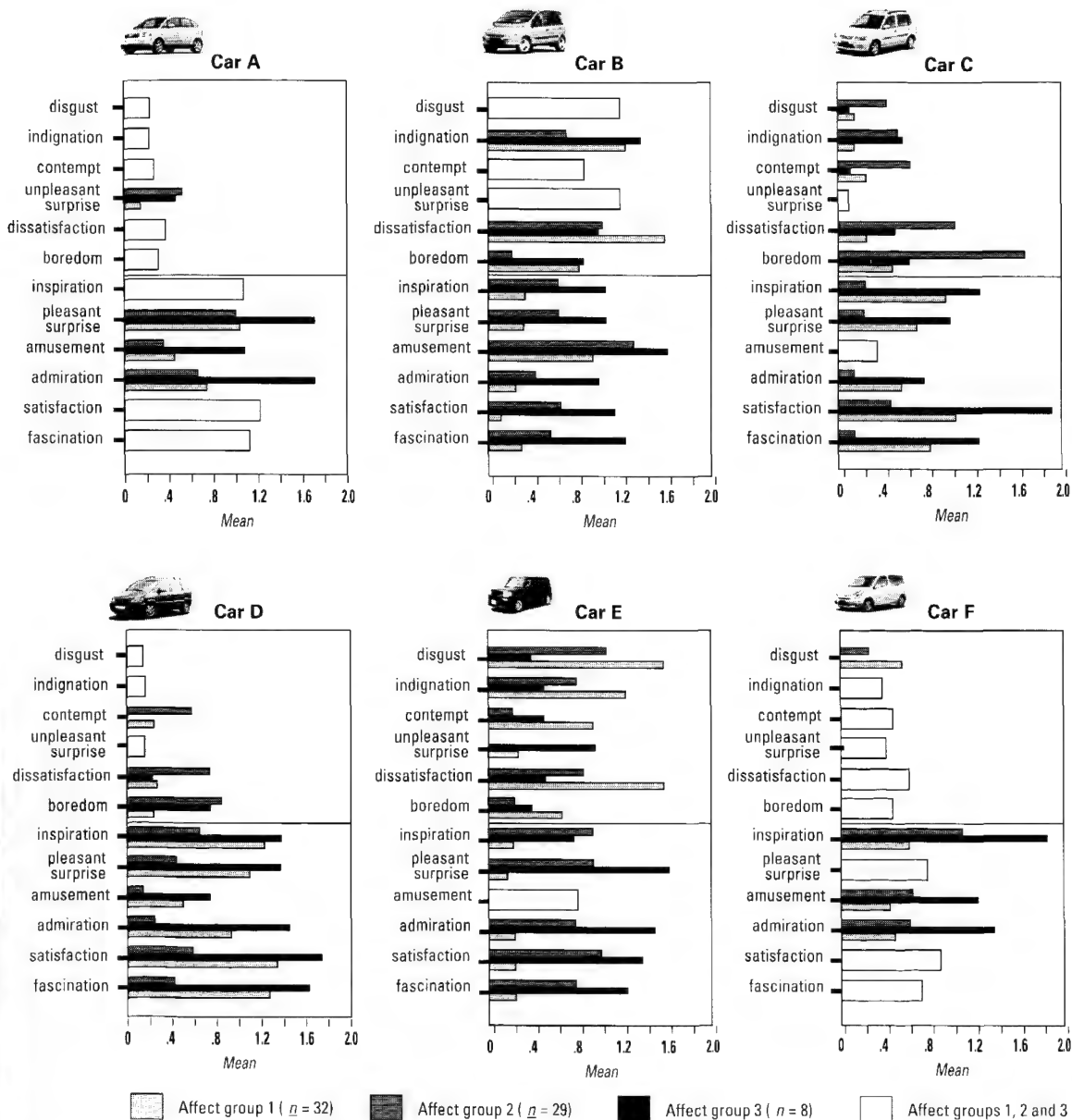
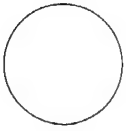


Figure 5-6 Relationship between affect-group membership and emotional responses.





of Car C (in Figure 5-3) are caused by between-affect-group differences. Affect-group 2 feels bored and dissatisfied, whereas affect-group 3 feels inspired and satisfied. From Figure 5-6, the following affect-group characteristics have been inferred:

Affect-group 1 (Participants: Japanese 12; Dutch 21)

The participants in the largest group were rather 'black-and-white' in their responses. They felt either high pleasant and low unpleasant or high unpleasant and low pleasant emotions. They felt strong unpleasant emotions towards Cars B and E. Car E especially evoked strong unpleasant emotions such as *disgust* and *dissatisfaction*. These were the two most 'pronounced' models. Towards less pronounced models, such as Cars C and D, they felt strong pleasant emotions, especially *inspiration* and *satisfaction*.

Affect-group 2: (Participants: Japanese 12; Dutch 16)

This affect-group was less extreme, 'hate it or love it', in their judgements than the other two groups. In general, these participants did not experience strong emotional responses. Group 2 differed from Groups 1 and 3 mainly in respect to the responses to Cars C and D. Whereas the other two affect-groups experienced relatively high pleasant emotions towards these car models, Group 2 experienced both low unpleasant and low pleasant emotions. These participants appeared indifferent to these two car models (except for *boredom*). Towards Car E they felt 'mixed emotions', that is high scores on all emotions (except *boredom* and *contempt*).

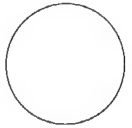
Affect-group 3: (Participants: Japanese 8)

As with affect-group 1, the participants in this small Japanese group are rather 'black-and-white' in their responses. These participants differed from those in Group 1 mainly in their response to Car E. Whereas Group 1 experienced strong unpleasant emotions, Group 3 experienced strong pleasant emotions (e.g. *pleasantly surprised* and *admiration*). One particular response of this group that catches the eye is that it experienced a strong feeling of *inspiration* towards Car F. This group generally seemed to have a high feeling of *inspiration* (M-Group 1 = 1.71; M-Group 2 = 1.78; M-Group 3 = 2.36). The same applied to *fascination*. These participants generally experienced few unpleasant emotions. An exception was Car B, which elicited 'mixed emotions.' This car model had moderately high scores on *all* emotions (e.g. *admiration*, and *indignation*).

## 5.6 Discussion

In Study 8, some possible PrEmo applications were demonstrated. Product emotion profiles can be drawn up and participants can be clustered in 'affect-groups' on the basis of their responses. In Study 7, PrEmo was found to be an adequate alternative to verbal rating scales. Study 8 showed the obvious advantage of PrEmo over the





use of verbal rating scales: language independence. In emotion research, translating emotion words is known to be difficult (see Chapter 3 of this thesis). The reason is that for many emotion words a one-to-one, 'straight' translation is not available. Between-culture comparisons are therefore problematic. Study 8 illustrated that an important quality of PrEmo is that it overcomes this translation problem.

### **Affect-groups**

One of the main objectives of Study 8 was to find out if PrEmo assessments can be used to identify between-participant differences in emotional responses. In this chapter's introduction, the Fiat Multipla was used as an example. It was proposed that while one person might be *disgusted* by this car, another might be *inspired*. Although merely proposed as an example, this was indeed supported by the study's results. It was found that some participants had similar emotional responses to the car models, while others were completely different – if not opposite. Moreover, it was found that, on the basis of these measured differences, participants can be clustered in 'affect-groups.' Participants within affect-groups experience comparable emotions, whereas those between subgroups experience different emotions.

Given the popularity of segmenting consumer groups on the basis of demographic characteristics, another aim was to investigate the association between emotional responses and such demographic characteristics. It was expected that associations would be found between emotions and age, gender and culture. In contrast to these expectations, no such associations were found. It seems that neither age nor gender can be used to explain variance in emotional responses towards the car models.

### **Differences between cultures**

Culture, on the other hand, was found to produce a significant effect on the emotional responses. Some interesting culture effects have been found. For three emotions, cultural differences that were independent of the car model were found. Japanese participants showed higher mean scores on the following emotions: *admiration*, *satisfaction* and *fascination*. This may point to a cultural difference in how car models are experienced: Japanese people are generally more admiring of, satisfied and fascinated by the car models than the Dutch. It would be interesting to investigate if the same cultural differences can be found using other kinds of products.

Some Car x Culture interaction effects indicated that there are also cultural differences in responses with respect to the particular car models used in the study. For example, the Dutch participants were not amused by the same car model as the Japanese.

A strong relationship was also found between the affect-group membership and nationality. Particularly striking was the fact that one (small) affect-group was composed *only* of Japanese participants. It seems there is a group of Japanese people



that does not have a Dutch equivalent with respect to their emotional responses towards these car models. The other affect-groups contained both Japanese and Dutch participants.

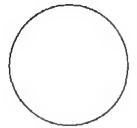
A final notable finding was that, contrary to expectations, cultural differences cannot be explained by product-familiarity. For instance, for Car B (Fiat Multipla) no significant cultural differences were found with respect to the emotions it elicited. This was not expected, because the Dutch participants were familiar with this model and the Japanese were not.

These findings confirm the idea that in product development, cultural differences must be recognized, and that these differences are both difficult to predict and to explain. Companies involved in 'global marketing' (i.e. developing and marketing products for the world-market) should be aware of these differences and should perhaps develop various design strategies for different cultures, instead of attempting to market identical products in different countries.

### **Measuring product emotions**

What is the point of measuring emotions elicited by products? In Studies 7 and 8, the research questions were focussed on assessing the validity and exploring the application possibilities of PrEmo. Naturally, when PrEmo is actually applied other research questions will be asked. The first possible question that comes to mind is "what are the associations between the measured emotions and design characteristics?" It is interesting to discover which particular emotions are elicited by a set of chairs or cars or any other products. However, it would be even more interesting to understand *why* these products elicit those emotions. If it were known why participants in a particular affect-group experience particular emotions to a given product then this information could be used in the development of new products, to elicit pre-determined emotion profiles. If that were possible, a designer would be able to start a design project with an 'emotion strategy' that could be developed for application not only in the design of the product but also in the marketing activities.

The results of Studies 7 and 8 cannot be used to settle this issue. The stimuli applied in these studies were not manipulated systematically but differed in material, shape, colour, etc. It is therefore not possible to pinpoint associations between design characteristics and emotional responses. Is a participant inspired by Car B because of its colour, its general shape, or a particular design detail? Moreover, although the brands were masked, it is not inconceivable that some participants recognized brands by the shape of the model. Some participants might have been familiar with some of the models and unfamiliar with others. Some might even have owned one of these models. Naturally, if one wants to investigate the associations between design characteristics and emotional responses, it is important to control for these characteristics in the research design.



A second application possibility would be to use PrEmo data to segment consumer groups on the basis of their emotional responses. In Study 8, three subgroups of participants were found. These affect-groups may be an interesting alternative for traditional market segmenting approaches, because it was found that traditional segmentation characteristics (i.e. age and gender) had no effect on the emotional responses. Apparently gender and age are less related to product emotions than is sometimes assumed. Given this finding, how does one describe the affect-groups? Besides their emotional responses, do participants within groups have anything in common?

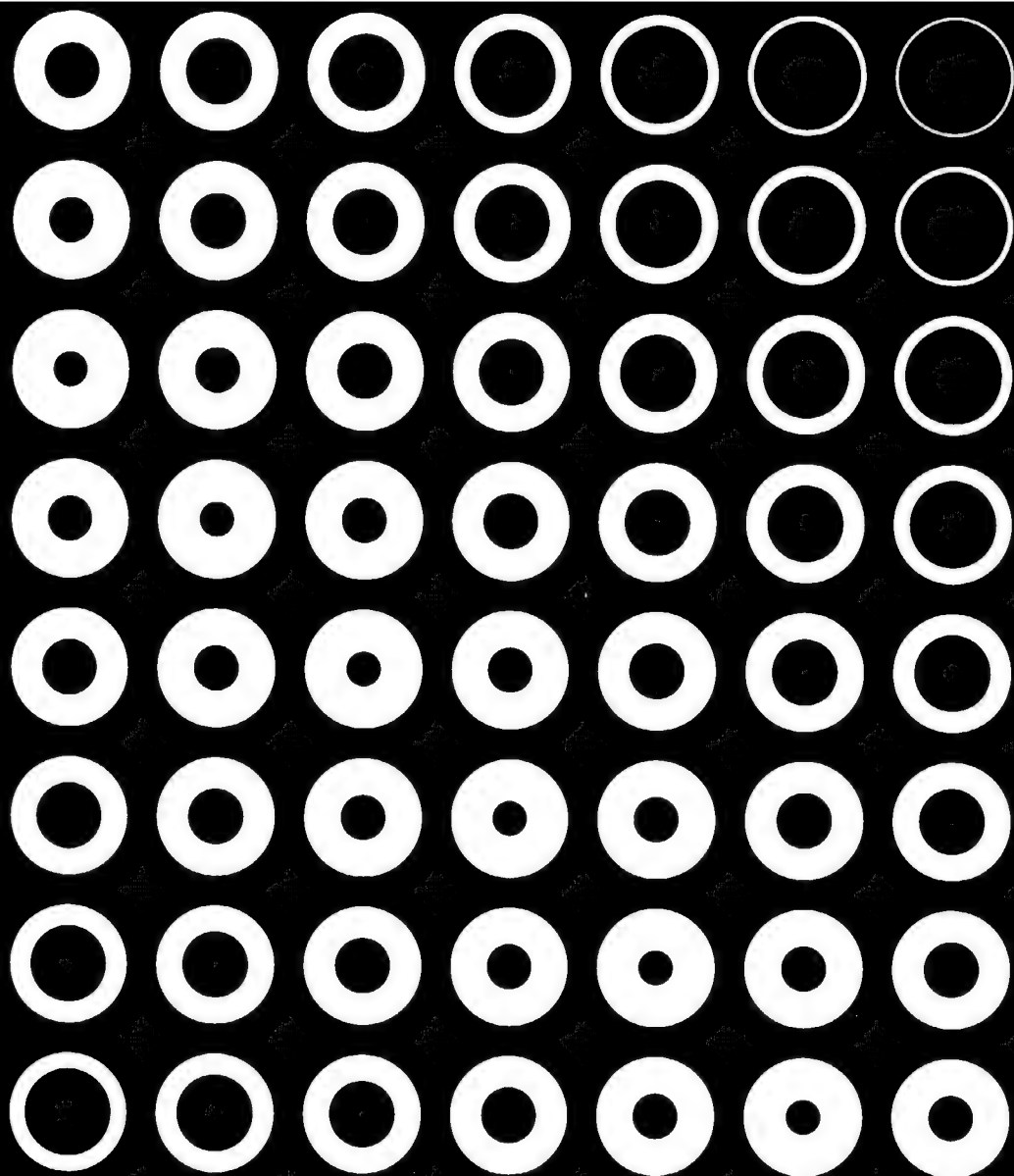
The discussion in Part A on how emotions are elicited (and differentiated) by appraisals, might be of assistance (see Section 1.2). Emotional responses are an outcome of an appraisal process, and each distinct emotion is elicited by a distinct appraisal. Participants who have similar emotional responses to a particular car model apparently *appraise* this car in the same way. It may be that participants within affect-groups can be described in terms of how they appraise product appearance. Because this appraisal might be the key variable that links the emotional responses to product appearance, it is the subject of Part C of this thesis.

## Notes

- [1] Study 8 was performed with participants of two different nationalities (i.e. Dutch and Japanese). In the current study it is assumed that participants of these two nationalities also represent two different cultures. Although Study 8 is an *international* study, it is therefore reported as an *intercultural* study.
- [2] The results of validation Study 6 became available only after Study 8 was performed. As a consequence, at the time of Study 8, it was not known that the animations portraying *desire* and *disappointment* were not valid (in Japan). These two animations have therefore been applied in Study 8. However, because it is now known that the portrayals of these two animations are not accurate, the responses measured with them are not reported.
- [3] Correspondence analysis is a technique for describing the relationship between two nominal variables (e.g. emotions and car models), while simultaneously describing the relationship between the categories of each variable (e.g. measured emotions). In the current study the first variable was Emotion (12 levels). The second variable was a combined Car x Culture factor with 12 levels (i.e. Car1xNL, Car1xJ, Car2xNL, Car2xJ, etc). Because the technique is descriptive, it is primarily intended for exploratory data analysis. Correspondence analysis has no method for conclusively determining the appropriate number of dimensions. To determine the number of dimensions, the researcher must balance interpretability against the parsimony of the data representation.
- [4] To create graphical 'emotion profiles' of the car models (i.e. profiles that exemplify the between-car differences in elicited emotions), a factor analysis was performed over the 12 measured emotions. Factor analysis is a technique often used for data reduction. It identifies a small number of factors that explain most of the variance observed in a much larger number of variables. On the basis of the scree test criterion, three factors were extracted (which together explain 69.65 percent of the overall variance). All pleasant emotions loaded on the first factor, four unpleasant loaded on the second, and the two remaining emotions (i.e. *boredom* and *contempt*) loaded on the third factor. Because in this solution the emotional responses were reduced to only three factors too much information was lost to allow for clear interpretation. It was therefore decided not to use the results of this study, but to create emotion profiles that report the ratings on each distinct emotion.
- [5] In this analysis, participants were grouped in one of two age groups: Group 'younger' = age 20 to 40, and Group 'older' = age 41 to 60.



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## **Part C**

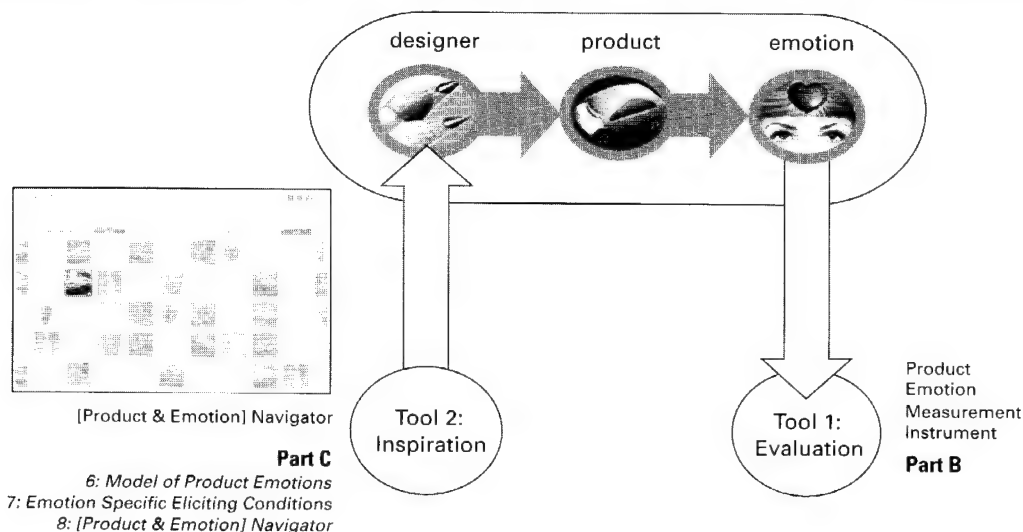
### Designing Emotions



# 6: The basis of product emotions



Figure 6-1 Designing Emotions, Part C.



## 6.1 Introduction

Part A of this thesis examined the (kind of) emotions that are elicited by product appearance. In Part B, an instrument to measure these 'product relevant' emotions was developed. This instrument was the first of two tools that were developed in the research project (see Figure 6-1). The development of the second tool, i.e. the [product & emotion] navigator, is reported in Part C – the current part of this thesis.

From the previous chapters we know the emotions that are often elicited by product appearance, and how these emotions can be measured. Attention is now shifted to the question 'how can designers manipulate the emotions elicited by their designs?' Although the question seems to be simple, the answer is not so simple. The complexity of product emotions is best illustrated by the results of Study 8 (i.e. emotions elicited by six car models), which was reported in Chapter 5. In that study we saw that emotional responses are both difficult to predict and difficult to explain. It was possible to identify 'emotion profiles' that differentiate between car models, but at the same time it was not possible to explain *why* particular cars elicited particular emotion profiles. It was also possible to cluster respondents into 'affect-groups' on the basis of their emotional responses. Again, it was not possible to explain *why* the people in different affect-groups experienced different emotions, and why they experienced those particular emotions. We saw that culture influences emotional responses, but we were unable to explain these differences. In short, the



interpretation of the results suffered from a lack of theoretical propositions about how product emotions are related to the products' appearance and the characteristics of the person who experiences the emotions.

The first step in the development of a tool which will support designers in manipulating the emotional impact of their designs was, therefore, the development of a 'model of product emotions' that explains *how* products elicit emotions. In the current chapter this model is presented and discussed.

The model of product emotions was developed to meet certain requirements. First, it should offer general propositions about the emotion process, including setting out the key variables and the ways in which they operate. It should also explain the role of the product's appearance in the eliciting conditions of emotions.

During the development of the model, special attention was given to explaining the three characteristics of product emotions that were mentioned in the introduction to this thesis: product emotions are personal (i.e. two people can experience completely different emotions towards the same product), and temporal (i.e. a person may experience one particular emotion in a showroom and yet a completely different emotion after buying the product), and can be mixed (i.e. a person is able to simultaneously experience more than one emotion towards a particular product).

In the last 20 years, several researchers have developed appraisal theories that aim to explain the process of emotions. Although divided on the issue of the precise nature of the relationship between appraisals and emotions, these researchers generally agree that each particular emotion is the outcome of a unique appraisal (e.g. Arnold, 1960; Lazarus, 1991). Given the acknowledged relationship between emotion and appraisal, the process of appraisal was used as a key variable in the model of product emotions. Besides the appraisal, the model identifies two more key variables that determine if a product elicits an emotion, and if so, which emotion is elicited. The basics of the model are introduced in Section 6.2. In the next sections each of the model's key variables is examined in more detail. In the final section, i.e. Section 6.4, some implications of the model for design practice are discussed.

## 6.2 Basic model of product emotions

People differ with respect to their emotional responses towards a given product. Nevertheless, in spite of these interpersonal differences, the process of emotion, i.e. the way in which emotions are elicited, is universal. This section presents a basic process model of product emotions. The model describes the eliciting conditions of emotions with the use of three underlying key variables: stimulus, concern and appraisal. Furthermore, the implications of this model for the relationship between a product's appearance and product emotions are discussed.



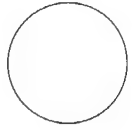
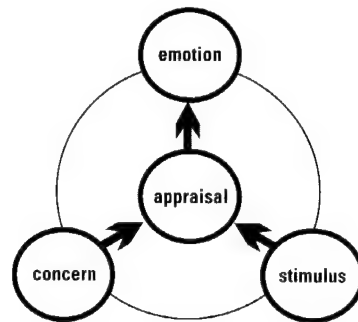


Figure 6-2 Basic model of emotions.



In Chapter 1 (Section 1.3), three theoretical perspectives on emotions were reviewed, i.e. the evolutionary, bodily-feedback, and cognitive perspective. The cognitive perspective was identified as promising for explaining *how* products elicit emotions. This perspective uses the concept of appraisal to explain the elicitation process of emotions. In the definition of Arnold (1960, p.182), emotion is “the felt tendency toward anything intuitively appraised as good (beneficial) or away from anything intuitively appraised as bad (harmful).” For the current research a basic model of emotions was drawn up on the basis of this definition and on the related appraisal models developed by psychologists such as Roseman (2001), Ortony et al. (1988), and Lazarus (1991). This model, which is shown in Figure 6-2, visualises the eliciting process of emotions.

Three key variables are identified in the basic model: (1) appraisal, (2) concern and (3) stimulus. These three variables, and their interplay, determine if a stimulus (which can be a product or any other stimulus) elicits an emotion, and if so, which particular emotion is experienced. The model and its key variables are explained with a product example: imagine Anne and Thomas spotting a turntable in the Antwerp flea market.

#### *Anne, Thomas and their turntable*

Anne and Thomas are strolling through the flea market when suddenly Anne spots a splendid turntable. It is designed in her favourite style: the pastel colours of the fifties. Moreover, there appears to be not a single scratch on it. Instantly she feels the desire to buy it. Unfortunately, the (honest!) salesman points out to her that the bottom of the product is slightly damaged. As a result, she feels a bit disappointed. Thomas' feelings are quite different. The turntable reminds him of their mother, who made him watch while she danced to the music of her John Denver record collection. This is not one of his most cherished youthful memories. As a result, he feels slightly contemptuous. In spite



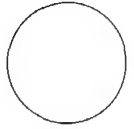
of her disappointment, Anne still decides to buy the turntable. After all, who's going to inspect the bottom of it? At home, she immediately installs it and tries to play one of her old albums. To her *(unpleasant) surprise*, she finds that there is something wrong with the turntable. The speed is too high and, as a result, the music sounds high-pitched and silly. Thomas on the other hand, is *inspired* by these strange sounds. He feels that at that speed these old '80 records sound amazingly up to date. When she notices how Thomas responds to the weird sounds, Anne starts to feel better about her purchase. Actually, she feels rather *proud* of the fact that she discovered this 'unique' piece of equipment. She cannot wait to tell her friends and is already on the phone, inviting them round for a visit. While she is making her calls, Thomas sits back, closes his eyes, and *enjoys* the music (not noticing his mother entering the room carrying a cardboard- box – filled with her Denver vinyl)!

### (1) Appraisal

According to appraisal researchers, *all* emotions are preceded and elicited by an appraisal (Roseman & Smith, 2001). An appraisal is a non-intellectual, automatic evaluation of the significance of a stimulus for one's personal well-being (see Section 1.3). It is this personal significance of a product, rather than the product itself, which causes the emotion. Because appraisals mediate between products and emotions, different individuals who appraise the same product in different ways will feel different emotions. Thus, the occurrence of Thomas's inspiration versus Anne's unpleasant surprise in response to the turntable's high pitch is the result of their different appraisals. Thomas, who felt inspiration, evaluated the turntable's sound as beneficial, whereas Ann evaluated it as harmful. Similarly, a given individual who appraises the same product in different ways at different times will feel different emotions. At first, Anne felt unpleasantly surprised because she appraised the strange sound as harmful to her well-being, but later she felt proud because she appraised the same sound as beneficial. Furthermore, a person can also appraise a given product in different ways simultaneously, and thus experience 'mixed emotions.'

### (2) Concern

Every emotion hides a concern, that is, a more or less stable preference for certain states of the world (Frijda, 1986). According to Frijda, concerns can be regarded as points of reference in the appraisal process. Thus, the significance of a stimulus for our wellbeing is determined by an appraised concern match or mismatch: stimuli that match our concerns are appraised as beneficial, and those that mismatch our concerns as harmful. This principle also applies to products: a product elicits an emotion only if it is appraised as relevant to a person's concern. Why was Anne proud of her turntable? Because it matched with her concern for social acceptance. Why was Thomas inspired by the strange music? Because it matched his concern for



creative stimulation. The number and variety of human concerns is vast. Types of concerns reported in the research literature are, for example, drives, needs, instincts, motives, goals and values (see Scherer, 2001). Some of our concerns are universal, for example the concern for safety, for love and for self-esteem. Others are more personal, like Anne's concern for fifties design, and her mother's concern for the music of John Denver. Some concerns, such as the concern for happiness and righteousness, are abstract. Others are more concrete, such as the concern for being home before dark or for owning a sports car.

### (3) Stimulus

According to Frijda (1986), any perceived change has the potential to elicit an emotion.<sup>1</sup> This can be some event, e.g. someone saying something to us or encountering an object. Anne's disappointment was evoked by the event of seeing the damage on the bottom of her turntable. Not only actual events but also remembered or imagined events have the potential to elicit emotions. We all know from experience that thinking of someone we love is sometimes enough to elicit strong emotions. Or *merely fantasising about a planned summer vacation can fill us with anticipatory excitement*. Similarly, Thomas's contempt was elicited by the remembered event of his mother's dance routines.

The basic model of emotions presented in Figure 6-1 is general, because it is applicable to *all* possible emotional stimuli. The current research, however, is not focussed on stimuli in general, but on a particular kind of stimulus, i.e. product appearance. In Chapter 2, we saw that products elicit some emotions often (e.g. boredom, desire) and others (almost) never (e.g. fear, shame). In other words, given the focus on the stimulus 'product appearance,' the possible outcomes of the appraisal process are (often) limited to a particular set of emotions. These emotions have been identified as 'product relevant emotions.' Consequently, the focus of the basic model can be narrowed down to apply specifically to emotions elicited by the appearance of products. This specified version of the basic model is shown in Figure 6-3.

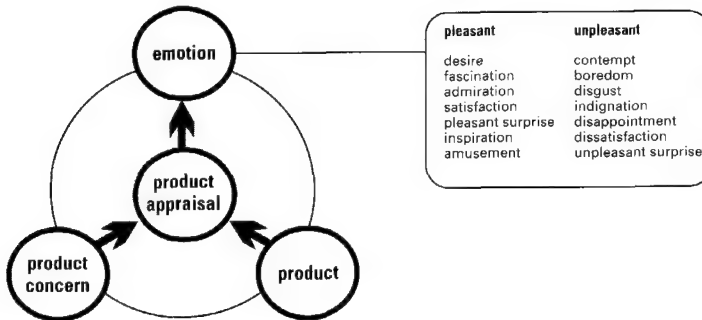
As stated in Chapter 2, emotions elicited by products are not a special type of emotions. The disappointment experienced by Anne towards her turntable is similar to the disappointment she would feel if her brother were to let her down. Therefore, the only difference between the general model in Figure 6-2 and the product model in 6-3 is that the latter is a *particularization* (or constrained version) of the first.

The relationship between product design and emotional responses.

To talk of a basic model of emotions implies that there are probably only a few one-to-one (universal) relationships between a product's appearance and the emotions it elicits. The reason for this is simply that the appraised significance of the product, rather than the product itself, elicits the emotion. As a consequence, any product can



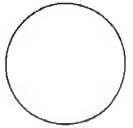
Figure 6-3 Basic model of product emotions.



elicit many different emotions because it may be appraised in several ways.

Nevertheless, some more or less universal relationships exist. These relationships become apparent when we compare consumer products with other products of culture, such as movies or theatre productions. It seems that the people who produce movies are often successful in using 'universal emotional stimuli.' Visiting a cinema one can witness a theatre full of people who (more or less) are all experiencing the same emotions at the same time. The reason for the one-to-one relationships between some movie scenes and the audience's emotions is that these scenes touch upon concerns that are shared by all people in the audience. In other words, these scenes touch upon universal concerns like love, fear of death, etcetera.<sup>2</sup> Products can also touch upon universal concerns. For example, many of us may experience fear towards a large, sharp kitchen knife because we appraise it as a potential threat to our (universal) concern for physical safety. Even with this example, however, there are exceptions. A gourmet cook may experience inspiration rather than fear, because in his eyes the sharp knife is not an expression of danger but of his cooking skills. Nevertheless, products that may harm or threaten or promise to fulfil basic universal concerns are more likely to elicit universal emotions than those that do not.

In many cases, however, products are appraised as relevant for concerns that are less universal. In these cases, although there is no one-to-one relationship between product and emotion, and different people will experience different emotions, the way in which they experience emotions is still universal. Smith and Lazarus (1993) found strong and invariant one-to-one relationships between particular appraisals and particular emotions. Thus, different products will elicit the same emotion (e.g. contempt) if they are appraised in similar ways (e.g. as inferior). Where Thomas was inspired by the strange sound of Anne's turntable his mother may experience a similar inspiration towards her Denver record collection. Both appraise these products as matching their concern for creative stimulation. Hence, although the products



are different, their appraised significance and underlying concern is similar.

The example of the inspiration of Thomas versus the inspiration of his mother illustrates that the variables '*appraisal*' and '*concern*' can be considered the keys to discovering the relationships between product design and emotions. In order to predict what emotional response someone will have towards a product we must know the person's concerns and how this person appraises the product. In Section 6.3, therefore, the key variables '*concern*' and '*appraisal*' are discussed in more detail.

### 6.3 The process of product appraisal

The basic model of emotions identified three variables in the eliciting process of emotions. We saw that, given the focus on products (instead of emotional stimuli in general), the variable '*emotion*' narrows down to a set of product relevant emotions. The question is whether the same applies to the other two variables, i.e. concern and appraisal. It may be that from all possible human concerns only some of them are evoked by products. Similarly, not all kinds of appraisals may be relevant for products. In this section, the influence on the focus on products of these two key variables is discussed.

In the previous section we saw that emotions are elicited by appraisals, i.e. evaluations of the significance of the stimulus for one's personal well-being. A product appraisal has three possible outcomes: the product is beneficial, harmful or not relevant for personal well-being (see Section 1.3). These three general outcomes result in a pleasant emotion, an unpleasant emotion or an absence of emotion, respectively. Although these outcomes explain why products elicit (pleasant versus unpleasant) emotions, they are too general to explain the differentiated nature of emotions elicited by products. Products can make us experience all kinds of emotions – fascination, inspiration, amusement, etcetera. These are all examples of pleasant emotions, and thus the outcome of an evaluated personal benefit. But why was Thomas inspired rather than fascinated or amused by Anne's turntable? The key to understanding the eliciting conditions of distinct emotions lies in the characteristics of the appraisal *process*.

#### Process of appraisal

Scherer (2001) conceptualised the '*process of appraisal*' as a cognitive process that consists of a *set* of distinct evaluations. In his view, the overall outcome of the appraisal process is the combined outcome of these evaluative issues. Each of these evaluative issues can be seen as a particular '*appraising question*.' In the case of products, the appraising questions relate to issues such as: "Does this product help me to attain some goal? Can I afford it? Will my neighbours approve? Is it safe to use it?" etcetera.

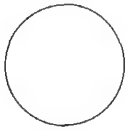
**Table 6-1 Emotions, appraisal types, and product appraisal types.**

Emotions	Appraisal types				Product Appraisal types
	Scherer	Smith & Ellsworth	Ortony, Clore & Collins	Roseman	
Disgust	Intrinsic pleasantness		Appealingness	Situational state	Appealingness
Disappointment			Desirability		
Dissatisfaction			Desirability		Motive compliance
Satisfaction	Motive consistency		Desirability		
Admiration			Praiseworthiness		
Contempt	Legitimacy	Legitimacy	Praiseworthiness	Agency	Legitimacy
Indignation			Praiseworthiness		
Pleasant surprise		Novelty	Expectedness		
Unpleasant surprise		Novelty	Expectedness		Novelty
Boredom	Novelty	Novelty			
Fascination	Novelty				

*Note: This table was based on: Scherer (1988, 2001); Smith and Ellsworth (1985, 1987); Ortony, et al. (1988), Roseman (1984, 2001).*

Many appraisal researchers have developed models that attempt to specify the evaluative issues that initiate specific emotions (see e.g. Frijda 1986; Roseman, 1991; Scherer, 1988; Smith & Ellsworth, 1985, Lazarus, 1991). Most of the appraisal models advanced to date include small sets of *appraisal types* to differentiate sets of emotions. Each appraisal type addresses a distinct evaluative issue. Although it is often not explicitly argued, many appraisal researchers agree that particular appraisal types are related to particular *concern types* (e.g. goals and beliefs).

An examination of the reported appraisal types indicates that although there is a significant overlap, there are also differences (see Scherer 1988; Roseman, Spindel, & Jose, 1990). First, the reported models differ with respect to the (number of) included appraisal types. Secondly, these models differ in respect to the particular emotions they can explain on the basis of the included appraisal types. In the research literature, no appraisal model was found that explains all 14 of the emotions measured by the Product Emotion measurement instrument (PrEmo). Although most models



include *some* of these emotions, none include *all*. Moreover, most models also include emotions that are not relevant for product design (e.g. shame). It was therefore decided not to adopt one particular model but to select appraisal types from well-accepted models proposed by four different authors.<sup>3</sup> Reviews of these models are summarised in Table 6-1.

The first column shows the 14 emotions that are measured by PrEmo. The second to the fifth column show the appraisal types that are proposed to elicit these 14 emotions. On the basis of these reported types, the sixth column depicts four proposed major *product appraisal types*: (1) appealingness, (2) legitimacy, (3) motive compliance and (4) novelty.<sup>4</sup>

Note that the emotions *inspiration*, *amusement* and *desire* are not covered by any of the reviewed models. Although these emotions are as relevant for the current research as those included in Table 6-1, they are not discussed in the current chapter because they cannot be explained by the reviewed appraisal models. On the basis of Study 9, however, they are discussed in detail in Chapter 7. Next, the four major product appraisal types and corresponding concern types are illustrated using the example of 'Anne's alarm clock.'

#### *Anne's alarm clock*

Anne bought an alarm clock for which she felt a strong desire because of its fantastic design. In spite of the nice design, Anne is dissatisfied because the clock has been irritating her with its awful, loud ticking. The noise of the clock is bugging her so much that she cannot sleep at night. Therefore, she has decided to buy herself a digital alarm clock. More specifically, she is considering the purchase of a radio alarm clock. In the store, while browsing through the stock, Anne is surprised by a completely new kind of alarm clock. It is a strange device with a large light bulb on the top. The text on the packaging claims that it wakens its user with light instead of sound, which is supposed to be a comfortable way of waking up. Anne had no idea that this kind of alarm clock existed. She wonders if it's possible to wake someone simply with a light bulb. Nevertheless, she is definitely fascinated. The idea of waking up with a fresh feeling – which is what is promised by the text on the package – convinces her to buy the clock. The next morning Anne wakens up in a bedroom that is bathed in a warm light, feeling both relaxed and refreshed. As a result, she is very satisfied and she admires the person who came up with the idea of creating such an original alarm clock.

#### (1) The appraisal of appealingness

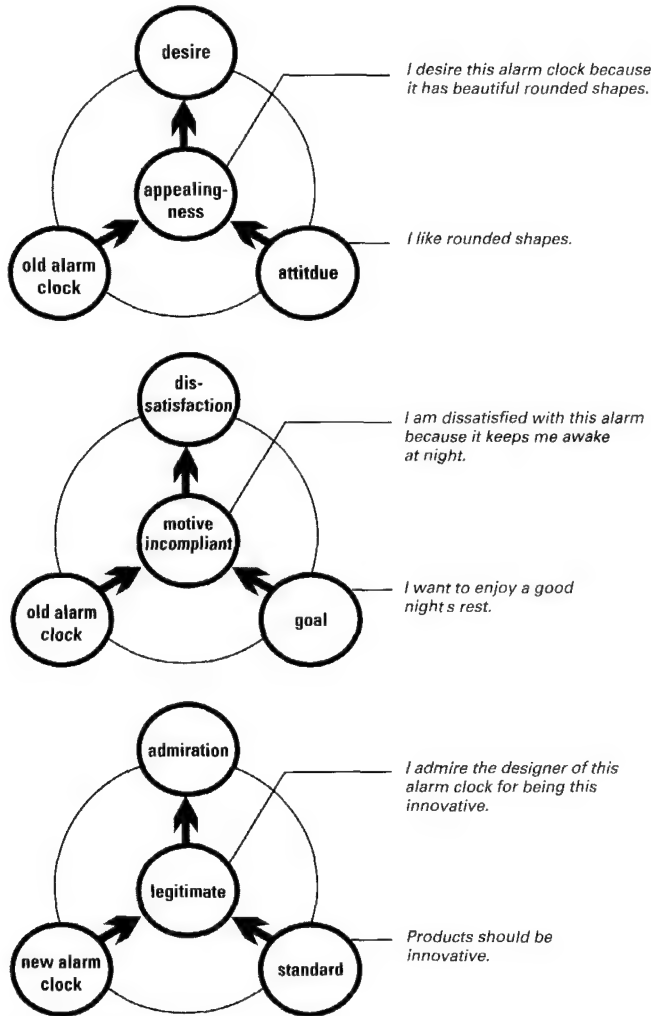
Anne desired her alarm clock because she liked the design.<sup>5</sup> In other words, the alarm clock's design matched with her taste (see Figure 6-4). Tastes are examples of the concern type *attitudes*, i.e. dispositional likes (or dislikes) for certain objects or attributes of objects (Ortony, et al., 1988).<sup>6</sup> In the turntable anecdote in the previous



**Figure 6-4** An example of the appraisal of appealingness.

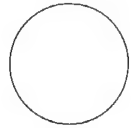
**Figure 6-5** An example of the appraisal of motive compliance.

**Figure 6-6** An example of the appraisal of legitimacy.



section, we saw that Anne has a dispositional liking for fifties design. This liking for fifties design is not her only *attitude*, she has many more – an *attitude* for natural materials and an *attitude* for high-tech audio equipment (see also the discussion of ‘sentiments’ in Section 1.2). Like Anne, all humans have many attitudes, some of which are innate (e.g. the innate liking for sweet foods) and others are learned (e.g. the acquired taste for oysters or wine). We have attitudes towards aspects or features





of products, such as the colour or the material. We also have attitudes towards product style (e.g. some people have developed a taste for the American style of car designs, whereas others have a taste for Italian design).

Our attitudes are the points of reference in the appraisal of appealingness. The design of a product that corresponds with one or more of our attitudes is appraised as appealing, and will elicit emotions such as *desire*. A design that conflicts with one or more of our attitudes is appraised as unappealing, and elicits emotions such as *disgust*. In the example of the alarm clock, the appeal was based on characteristics of the clock itself, e.g. its size, shape or other particular details. As a result, Anne's dispositional liking for a certain model will be generalizable to most or all members of the product class. Sometimes, however, the dispositional (dis)liking is restricted to one specific product. In those cases the liking results from previous usage or ownership of that particular exemplar. Someone may have a dispositional liking for a ring because it was a gift from someone special, or for a particular backpack because it travelled with them to many different countries. In these cases, the attitude is soaked with personal meaning due to the significant personal experience they had with the product. Such attitudes will not be shared by others and are not applicable to other exemplars of the product class.

#### (2) The appraisal of motive compliance

Anne was dissatisfied with her alarm clock because its loud ticking kept her awake (see Figure 6-5). The concern underlying her dissatisfaction was her goal to enjoy a good night's rest. After attitudes, goals are the second concern type. A goal is something we *want to attain*, i.e. it is how we would like things to be (Ortony, et al., 1988). Humans have numerous goals which range from abstract (e.g. I want to be happy) to concrete (e.g. I want my lunch). We have many kinds of goals that relate to consumer products. For example, we buy, own and use products because we believe they can help us to achieve things (a digital agenda to make us more organised), or because they fulfil a need (a bicycle fulfils the need for transportation).

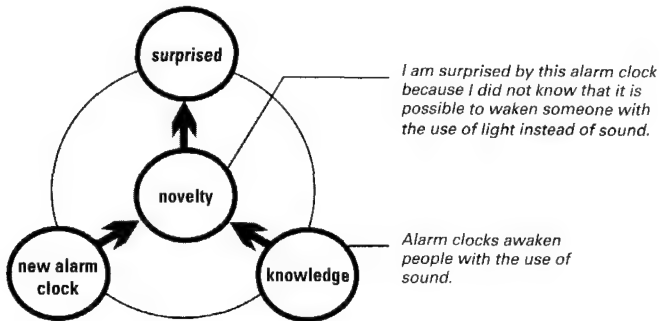
Goals are the points of reference in the appraisal of motive compliance. A product that satisfies or promises to satisfy a goal will be appraised as motive compliant and will elicit emotions such as satisfaction. Similarly, a product that obstructs or threatens to obstruct achievement of a goal will be appraised as motive non-compliant and elicit emotions such as dissatisfaction.

#### (3) The appraisal of legitimacy

Anne admired the designer who had come up with the innovative idea of creating an alarm clock that wakens her with light (see Figure 6-6). Her admiration was rooted in a belief of how alarm clocks are supposed to work. Our beliefs, norms or conventions of how we think things should be are our *standards*. Whereas goals refer to the state



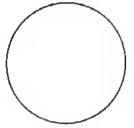
Figure 6-7 An example of the appraisal of novelty.



of affairs we *want* to obtain, standards are the state of affairs we believe *ought* to be (Ortony, et al., 1988; Scherer 1984, Frijda, 1986). For example, many of us believe that we should respect our parents, change our underwear every day, and eat more fruit and vegetables. These are our standards. Most standards are socially learned and represent the beliefs in terms of which moral and other kinds of judgmental evaluations are made (Ortony, et al., 1988). Whereas goals are relevant for our personal well-being, standards are relevant for the preservation of our social structures. We approve of things that comply with such standards and disapprove of things that conflict with them. We not only have standards regarding human (inter)action, but also regarding products. Some people may have a standard that designers or industries should always strive for original product solutions. Others may adhere to the norm of sustainability or safety.

A special type of standard is the *standard of performance* (or behaviour). Standards of performance are *role-based* norms (Ortony, et al., 1988). For example, most of us expect an Olympic champion to run faster than we can. Similarly, we expect to run faster than our grandparents. Thus, some beliefs about what is an acceptable, normal or expected way to behave are determined by the role in which the person is cast. Also with regard to products, our beliefs about what is acceptable, normal or expected depend on the role in which we cast the product. For example, I expect a robust looking watch to *be* robust and I expect an expensive, state-of-the-art computer to be faster than a cheap discount computer. These standards of performance may be based on information surrounding the product (e.g. commercials, in-store displays, brand knowledge), or on signals emitted by the product itself (e.g. appearance).

Standards are the points of reference in the appraisal of legitimacy. Products that meet our standards are legitimate and elicit emotions such as *admiration*. Products that conflict with our standards are *illegitimate* and elicit emotions such as *contempt* and *indignation*.



#### (4) The appraisal of novelty

Novelty appraisal differs from the other three types of appraisal because it is not related to a particular concern type. Instead, it is related to our knowledge and expectations. Anne was surprised because she was unfamiliar with the system of awakening with the use of light instead of sound (see Figure 6-7). She did not *know* that this kind of alarm clock existed. Products that deviate from what we know we appraise as novel. Many of us were surprised by the autonomic behaviour of the Sony robot dog Aibo. Once we have become familiar with the novel aspect of the product, it will no longer elicit surprise. Therefore these are often 'first-time-only' emotions. Explorers could amaze and delight the natives with mirrors and beads, simply because these were novel for the primitive people they encountered. The amazement of these people is not silly but logical, and no different from the amazement elicited by the first moving images on the white screen or the first voice transmitted through a telephone.

As well as unfamiliarity, an appraisal of novelty can also be based on unexpectedness. We expect the world to look, sound, feel and act in a certain way. We expect the day to pass in 24 hours and we expect unsupported objects to fall to the ground. We have numerous implicit expectations regarding products. For example, we expect the telephone only to ring when someone calls us. Similarly, we expect the inside of a fridge to be cold – not hot. A product can be consistent or discrepant with the individual's expectation concerning that product. Any product that deviates from our expectations is likely to be appraised as novel. If Ferrari were to design an inexpensive city car, such a car would be inconsistent with the preconceptions we have about the Ferrari brand. The inexpensive model would surprise some of us. Aspects or details of products can also elicit surprise. The weight of a ladder, for example, may be surprisingly light or a door handle may be surprisingly soft.

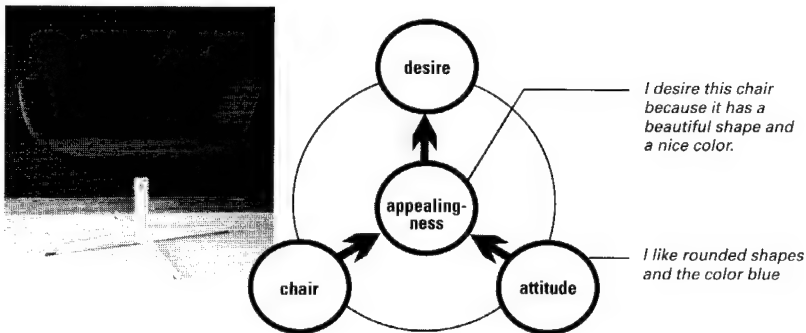
## 6.4 Products as emotional stimuli

The model of product emotions visualised in Figure 6-2 identifies three key variables in the eliciting process of emotions. Two of these variables, i.e. concern and appraisal, were explored in the previous section. One key variable has been left unexplored: the product itself. In this section, the ways in which products can be emotional stimuli are discussed. Subsequently, the results of this exploration are combined with the four product appraisal types and the three concern types into an elaborated version of the model of emotions elicited by product design. This section was written on the basis of a model proposed by Desmet and Hekkert (in press).

According to Ortony et al. (1988) there are three major aspects of the world on which we can focus: events, agents or objects. We can focus on an *event* such as a football match for its consequences: a loss for our favourite team. We can focus on an *agent*, such as a dog, for its actions: it is barking at us. And we can focus on an *object*, such



Figure 6-8 Example of an object-focus product emotion.



as a painting, because we are interested in certain of its properties *as such* (e.g. its composition). Each of these aspects can be an emotional stimulus. Although it is tempting to assume that only the third aspect, i.e. objects, is relevant for product emotions, the other two are no less important. Naturally, products are essentially objects – not agents or events. Nevertheless, products often provoke thoughts, memories, anticipations and fantasies, which can in their turn refer to either agents or events. Ortony et al.'s triad is therefore used as the framework for a discussion of how products can operate as emotional stimuli.

### (1) Products as objects

Like all objects, products or aspects of products can be viewed 'as such' in terms of their appealingness. In the previous section, we saw that products are simply liked or disliked for their appearance, for the way they look (see the chair in Figure 6-8). The emotional stimulus can be the overall product appearance or some particular product detail (e.g. the door handle of a car) or feature (e.g. the product's material or colour). Besides the product as such, associated objects can also elicit emotions. For example, a key chain can be associated with a particular car model. In such cases, not the object itself but the associated object is the emotional stimulus.

### (2) Products as agents

Agents are things that cause or contribute to events. It is not only humans or animals who can act as agents. Ortony et al. (1988) indicate that agents can also be inanimate objects such as products and they give the example, familiar to all of us, of a car that is blamed for its malfunctioning. Products are often blamed when their quality or functioning does not live up to our expectations. These expectations can be based on the product's appearance, price, packaging etcetera (see the skating boot in Figure 6-9). Products can also be treated as agents with respect to the presumed impact they generally have or may have on people or society. (see the gun in Figure 6-9).

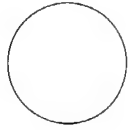
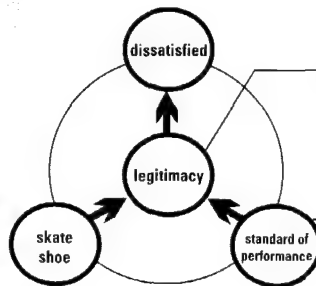
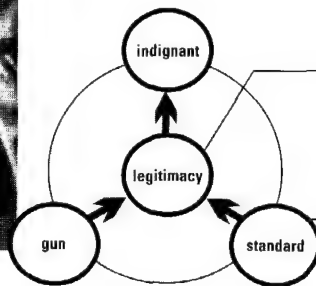


Figure 6-9 Examples of agent-focus product emotions.



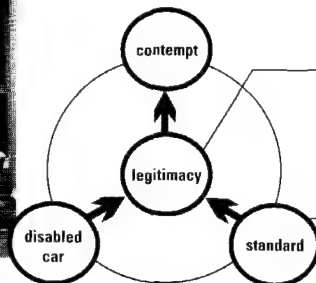
*This is a very expensive skate shoe. When I use them my feet hurt really badly. Now I have new (cheap) shoes which are much more comfortable. Therefore I am very dissatisfied with the expensive shoes.*

*Expensive shoes should be comfortable.*



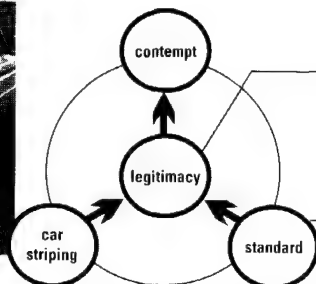
*I feel indignant when I look at this product because in my opinion it is responsible for too much suffering in the world.*

*People should not hurt each other.*



*I feel contempt for the person who designs such an ugly thing and dares to call himself a designer.*

*Designers should respect some aesthetic principles.*

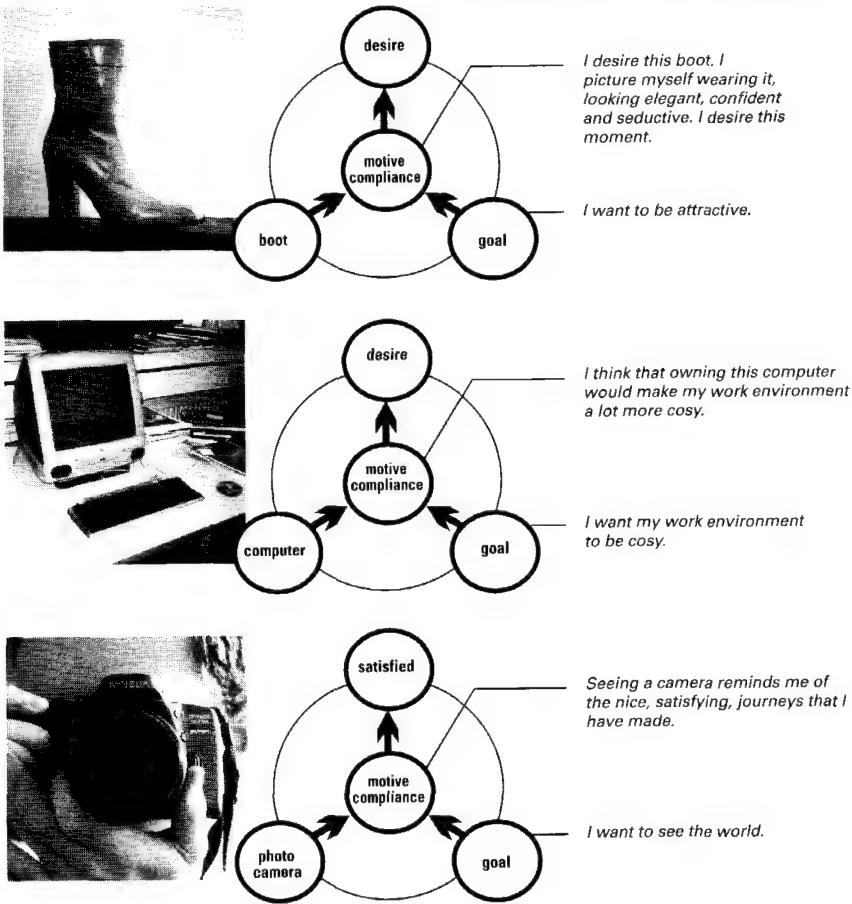


*My neighbor always bothers me. His car has stripes on it. As a result, every car with stripes reminds me of him.*

*One should not bother one's neighbors.*

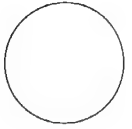


Figure 6-10 Examples of event-focus product emotions.



Mobile telephones, for instance, may be blamed for the disturbance they cause in public spaces such as trams or train compartments.

In some special cases, it is not the product itself that is treated as an agent but rather some company, institution or person the product refers to through association. Products are often seen as the result of a design process in which case the designer or company is the construed agent. When looking at a product one can praise the originality of its design(er) or blame the designer for its lack of product quality (see the disabled car in Figure 6-9). One can be happy to see that in computer design Apple has taken a step forward with its the iMac computer. The product represents a change in the company's focus, moving towards more interesting and



daring product design. A product can also be associated with a particular user group, in which case this user or group is the construed agent. Sometimes this association is based on personal experiences (see the car striping in Figure 6-9). In other cases, the association is more general and is shared by people within cultures or social groups. Some examples are German cars (company directors), skateboards (teenagers) and antimacassars (grandmothers).

### (3) Products as events

This type of stimuli appears to be the least relevant to product emotions. In the model of Ortony et al. (1988), the aspect of the world we are focusing on here is the consequence of an event. Although products are not events, two important classes of product emotions fall into this category. First, (A), is the inclination of people to anticipate the future use or possession of a product when they see one. The foreseen use or possession has become the event and the anticipated consequences elicit the emotion. Second, (B), products can symbolise past events. In those cases, the emotions are elicited by remembering the consequences of these past events.

*(A): Anticipated consequences.* When we see a Ferrari, we may think of the status that owning and driving it will give us and this fantasy can elicit an emotion like desire (see the boot and the computer in Figure 6-10). One of our goals may be to acquire status by impressing other people with our expensive car. In a similar way, each time we see a product we anticipate what goals it might facilitate, once it is bought or used. The power of anticipated consequences to elicit strong emotions is illustrated by the commercials and advertisements that surround us in our daily lives. Advertisements aim to create or enhance anticipations by convincing us, for example, that drinking a particular brand of beer will result in the great social life or the strong personality we would like to have.

*(B): Past consequences.* Although products are not events, they can be construed as symbols of past events. For example, seeing our old teddy bear can remind us that the untroubled days of our childhood have gone. The bear, symbolising the event of growing up and losing our childhood, can make us sigh with melancholy. The trophy we once won can fill us with joy because it reminds us of a celebrated victory. In those cases, the products symbolise meaningful personal events that are not shared with others. In a similar way to some cases of attitude emotions, these product symbols are related to particular product examples (see the camera in Figure 6-10). In other cases, the symbolic meaning is applicable to other exemplars of the product class. For example, seeing a lightweight machine gun makes us realise that society has become more violent than it used to be. The gun symbolises an unpleasant change (event) in society, and the resulting emotion may be sadness.



## 6.5 Discussion

The model of emotions visualised in Figure 6-2 applies to all human emotions: a stimulus elicits an emotion when it is appraised as either harmful or beneficial for one of our concerns. In the previous sections, how the variables 'concern,' 'appraisal,' and 'product focus' can be specified for emotions elicited by product appearance was explored. The results of these explorations are summarised in Figure 6-11. In the current section, the implications of this model are discussed.

### Characteristics of product emotions

In the introduction to this chapter, it was proposed that the model should address the following characteristics of product emotions: product emotions are (1) personal, (2) temporal and (3) can be mixed. In the following discussion, the model's key variables are used to discuss these three characteristics.

#### Product emotions are personal

Product emotions are the result of appraisals in which the relevancy of the product for our personal concerns is evaluated. In other words, the eliciting process *always* involves some concern, and because people differ in their concerns, they differ in their emotional responses. In some cases, product emotions seem to be 'universal,' i.e. experienced by all (or most) people. In Section 6.2, the example of the fear that most of us experience towards a large, sharp knife was used to illustrate that sometimes emotions are shared by more people because the product touches upon a concern that people share, in this case the concern of physical safety.

The example of the professional cook was used to illustrate that the variable concern is not the only cause of interpersonal differences. Although the cook (naturally) shares our concern of physical safety, he did not share our fear but instead experienced inspiration. The reason is that because of his profession the cook has a different *focus* on the knife. The focus of the people experiencing fear is the anticipation of the harm that may be done with the knife, whereas the focus of the cook may be the anticipation of creating a tasty dish. In short, different people experience different emotions towards a given product because people differ, both in their concerns and in their product focuses. At the same time, as with taste, some people have similar responses because they share their concerns and their product focus. Some product emotions are experienced by almost everyone, some by only one (e.g. when the focus is a personal memory attached to the product), and all others by groups of people (such as the 'affect groups' that were found in Study 8).

#### Product emotions are temporal

Emotions are not independent of time. It is possible to experience an emotional response towards a product one day and feel indifference the next. Again, the key to



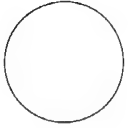
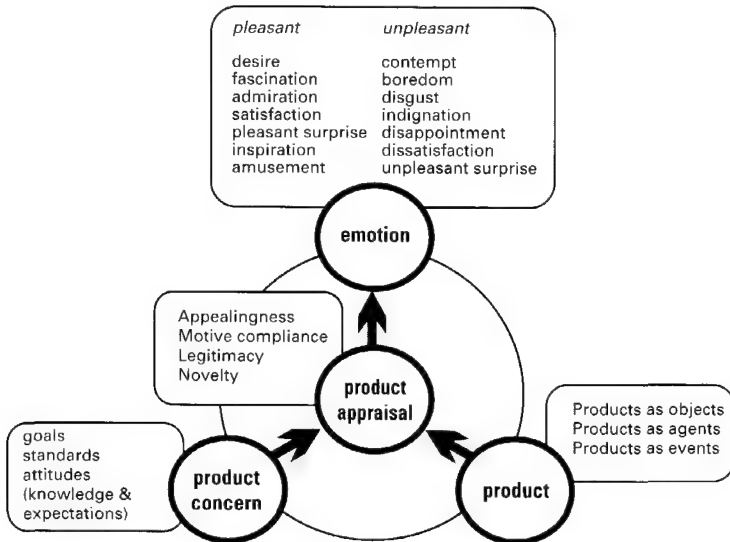


Figure 6-11 Elaborated model of product emotions.



understanding these temporal deviations lies in the role of concerns and product focus. Take, for example, a small, hand-held computer game. At the age of 12, Thomas desired this computer game. He anticipated the fun of playing with the game and the status that owning it would give him. However, at the age of 16 the game bored him. It no longer held any challenge for him, as he was no longer interested in 'games for children.' Now, he feels rather happy when he sees the game because he now has an attitude for rare things and retro-games. In time, our attitudes, goals, standards and our focus on products change. Consequently, emotional responses change with time. Although the example of Thomas described changes that took place over a period of years, these changes can also occur in days or even minutes.

#### Product emotions are mixed

Products can simultaneously elicit more than one emotion, simply because they can be construed as relevant for more than one concern. In Chapter 1, the distinction was made between R-emotions (emotions elicited by a fictional object that is represented by the product) and A-emotions (emotions elicited by the product as an object or by some associated object). In the previous sections we saw that products can elicit R-emotions when the focus is 'product as event' and A-emotions when the focus is 'product as object' or 'product as agent.' In reality, these focuses occur simultaneously, therefore different layers of product emotions can be distinguished. For



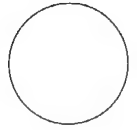
example, one might well be amazed by the sight of a diamond necklace on a cat. At the same time, one might feel attracted by it because it appeals to an aesthetic concern. Yet, even more, one might feel contempt for the person who chose to pay an exorbitant price to own such a thing. In this example, the mixed emotions are the result of concerns of different types that are present simultaneously. In other cases, different concerns of one type are appraised as relevant. For example, the Smart car might be appraised as desirable because it corresponds with Anne's goal of 'having an unique car,' and as undesirable because it conflicts with her goal of 'bringing a lot of luggage.' The car is indeed unique but it cannot transport all her luggage.

### **Implications for designers**

The most important characteristic of the model of emotions is that it illustrates that there is no one-to-one relationship between the design of a product and the emotion it elicits. An emotion is not elicited by a product as such, but by the appraised significance of this product for our concerns. As a consequence, emotions can only be understood in relation to the person who is experiencing them. Designers, therefore, can only predict or manipulate the emotional impact of their designs when they are aware of the concerns of the particular person for whom the product is designed. A second implication for designers is the fact that the object as such is often not the object of emotion. In many cases, the object of emotion is an associated agent, object or event. Also, when the product is the actual object of emotion, it can act as an object or as an agent (and probably in the dynamic interaction of usage it can also act as an event). Note that some of these emotional responses are beyond the designer's control. Personal meanings, through associations for example, are not predictable. Nevertheless, the more designers are aware of the particular concerns and product focuses that prevail for the product they design, the better they will be able to influence the emotional responses towards that design. The model could be useful as the provider of a structure for making an inventory of these concerns and particular product focuses.

### **The boundaries of the model**

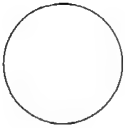
The model of product emotions provides a basic but incomplete explanation of how emotions are elicited by products. Firstly, it is important to remember that the model was developed on the basis of one specific type of interaction, i.e. passive observation. Although the basic model of product emotions can also be applied for more active types of interaction (e.g. using the product, buying the product, etcetera), the elaborated version is based on a set of emotions that prevail while looking at the product. As a result, the four appraisal types are typically related to perceiving the product, i.e. not owning or using it. For other types of interaction, other appraisal types might prevail. An appraisal of responsibility might be relevant when owning a



product. If there is a feeling of personal responsibility for a product, emotions such as pride and shame might be experienced.

Secondly, in describing the model the various concern types (i.e. goals, standards, and attitudes) have been treated as if they are mutually independent. In reality, they are intertwined. Our standards influence our goals and our goals influence our expectations, etcetera. A person can have the standard that people should use eco-efficient products. Consequently, when purchasing a product, this person's goal will probably be 'to buy a product that is eco-efficient.' The same applies to the appraisal types and the product focus types.

Thirdly, the model does not explain differences between emotions that are the outcomes of the same appraisal type. The emotions *contempt* and *indignation*, for example, are both outcomes of the appraisal of *legitimacy*. Nevertheless, they are different emotions. If one wants to understand the differences in eliciting conditions between these two emotions, it is necessary to specify the particular appraisals in more detail. In addition, the product appraisal types proposed in the current chapter may not be sufficient to explain all 14 PrEmo emotions (i.e. inspiration, desire and amusement have not been discussed). In the following two chapters, the eliciting conditions of all 14 PrEmo emotions are investigated in more detail (Chapter 7), and these eliciting conditions are used as a starting-point for the development of the product & emotion measurement tool (Chapter 8).



## Notes

- [1] In the “law of comparative feeling,” Frijda (1988, p. 353) actually proposed that emotions are not elicited by perceived changes as such, but by changes in relationship to our expectations. Take, for example, a mother who expects her daughter to call when she arrives at her holiday destination. The mother will experience worry or fear when her daughter does not make the expected call. In this case, the emotional stimulus is the *absence* of an expected event rather than an event. In this thesis, the role of expectations in the eliciting process of emotions is discussed in the ‘appraisal of novelty’ in Section 6.3.
- [2] Typologies of universal concern have been developed in the fields of organisational behaviour (e.g. Maslow, 1943), personality psychology (e.g. Murray, 1938), social psychology (e.g. Rokeach, 1973) and consumer behaviour (e.g. Hanna, 1980). Although researchers developing these typologies differ to a large degree in the terminology they use (i.e. needs, goals, commitments or values), they share an interest in abstract universal human ‘desired end states.’ Schwartz (1992), for example, developed an often-cited typology that includes 10 distinct value types (i.e. power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity and security).
- [3] Most appraisal researchers have proposed that emotions are elicited by ‘patterns of appraisal’ (Roseman & Smith, 2001). These patterns are *combinations* of appraisal types. For the current research, it was decided not to discuss these patterns because the literature shows little consensus on how (and which) appraisal types combine to produce what appraisal pattern. Moreover, most proposed patterns are complex and difficult to relate to emotions elicited by products. Instead, for each emotion measured by PrEmo the central appraisal type is discussed. Although this approach simplifies the reviewed models of appraisal, it offers sufficient insight to explain how products elicit emotions.
- [4] Clearly, as can be observed in Table 6-1, the authors cited apply different terminology. A reason for this is that they each operate from slightly different theoretical approaches. Whereas Roseman defines appraisal ‘dimensions,’ Scherer defines appraisal ‘criteria,’ and Frijda defines appraisal ‘components.’ However, in spite of these differences in terminology, there is a high degree of convergence with respect to the nature of appraisal types postulated by these different authors (Scherer, 1999). For the product appraisal types, labels have been used that are believed to best capture the consensus in terminology across authors.
- [5] One may wonder why the emotion *desire* is used as an example in the anecdote, because it is not included in Table 6-1. The reason is because, as will be discussed in Chapter 7, this emotion (i.e. desire of presence) can be elicited by an appraisal of appealingness.
- [6] In the field of social psychology, ‘attitude’ is often defined as “enduring clusters of feelings, beliefs, and behaviour tendencies relating to any object, person, issue, or group” (Baron, Byrne, & Kantowitz, 1981). In this definition, an attitude toward any entity in the world consists of (1) your positive or negative feelings toward it, (2) your beliefs about it, and (3) your behaviour tendencies regarding it. In the definition of Ortony, et al. (1988) that was adopted for the current research, feelings and behaviour tendencies are not considered to be elements of the attitude but rather of the appealingness emotion that is related to this attitude.

# 7: Emotion-specific eliciting conditions



## 7.1 Introduction

In the previous chapter, a basic process model of emotions was introduced (see Figure 7-1-a). In this model three key variables, i.e. concern, product focus and appraisal, are used to explain how products elicit emotions. The model's central claim is that all emotions are outcomes of an elicited match or mismatch between a product (or any other stimulus) and a personal concern. Pleasant emotions are elicited by products that satisfy some concern, or increase the likelihood of satisfaction. Similarly, unpleasant emotions result from products that threaten or harm some concern.

This model is general and applies to all (human) emotions. Because the current research is not focussed on emotions in general, but on emotions that are relevant for product design, a particularisation of this model was made. In this specified model, some appraisal types and concern types are distinguished. Furthermore, the ways in which products can act as emotional stimuli are discussed (see Figure 7-1-b). The combination of the three key variables shapes the 'patterns of eliciting conditions' of emotions. Each distinct emotion is the outcome of a unique pattern.

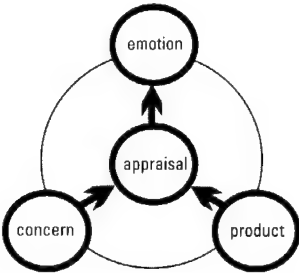
Although revealing, the process model does not fully explain how distinct emotions are elicited by products. It is not clear how the key variables combine to form patterns that lead to each of the 14 emotions measured by PrEmo. The aim of the current chapter is, therefore, to define the patterns of eliciting conditions of each of the 14 emotions measured by the Product Emotion measurement instrument (see Figure 7-1-c).

In Section 7.2, Study 9 is reported, in which underlying patterns of eliciting conditions are derived from anecdotal cases of emotions elicited by products. On the basis of this study, the patterns of each of the 14 emotions are defined, and illustrated with examples drawn from the study. The starting-point for the discussion of the results is the proposed relationships between the four central appraisal types and the 14 PrEmo emotions. The results are therefore discussed in five sections (i.e. Sections 7.3 to 7.7) in accordance with the appraisal types (see Table 7-1). In section 7.7, the implications of the established patterns of eliciting conditions for design practice are discussed.



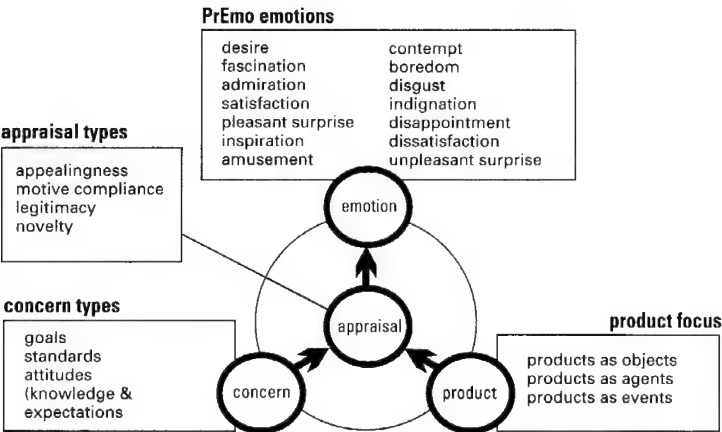
Figure 7-1 Modelling product emotions.

A



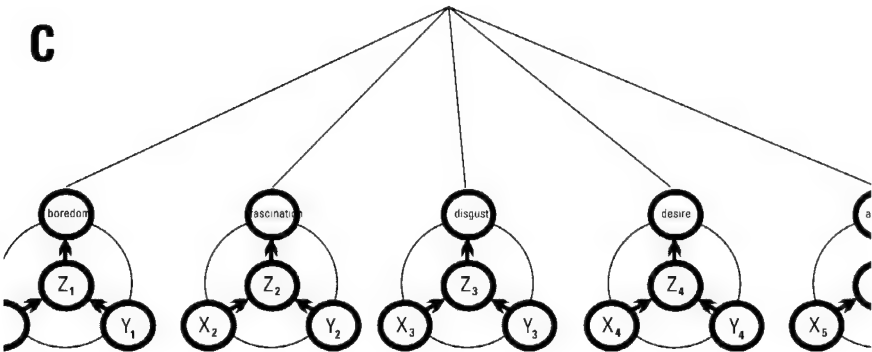
Basic process model of emotions

B

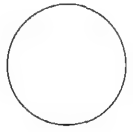


Specified model of product elicited emotions

C



Patterns of eliciting conditions for the distinct emotions

**Table 7-1 Relationships between emotions, appraisal types, and concern types.**

Product emotions	Appraisal type	Concern type
Disgust	Appealingness	Attitude
Contempt; admiration; indignation	Legitimacy	Standard
Disappointment; dissatisfaction; satisfaction	Motive compliance	Goal
Pleasant and unpleasant surprise; boredom; fascination	Novelty	(Knowledge and expectations)
Desire; inspiration; amusement	-	-

*Note: Knowledge and expectations are placed in brackets because (although relevant for the given emotions) they are not considered to be concerns.*

## 7.2 Patterns of eliciting conditions – Study 9

The basic process model of emotions shown in Figure 7-1 sets out the three key variables which shape the conditions that elicit and differentiate emotions. Although the model sets forth the key variables, it is too general to explain the particular conditions that elicit the 14 distinct emotions measured by PrEmo. Study 9 was therefore performed to examine the particular eliciting conditions of these emotions. The results comprise 14 emotion-specific patterns of eliciting conditions, described in terms of 'appraisal,' 'concern type,' and 'product focus.'

The aim of Study 9 was to establish the patterns of eliciting conditions of all 14 emotions that are measured by PrEmo. The three key variables in the basic model of emotions (see Figure 7-1) shaped the framework for these patterns. In the previous chapter, a start was made by proposing that the pattern of eliciting condition for each emotion involves a particular concern type and a particular appraisal type. The emotion *contempt*, for example, is always elicited by an appraisal of 'legitimacy,' and always involves a concern of the 'standard' type. The proposed relationships between emotions, appraisal types, and concern types are shown in Table 7-1. Although these relationships were a first step towards understanding how the 14 PrEmo emotions are elicited, they were not sufficient fully to explain these emotions' patterns of eliciting conditions. To establish 14 distinct patterns, the following three questions had to be answered:

- (1) The first question was how the general appraisal and concern types combine with the key variable 'product' to produce emotion-specific eliciting conditions. In Chapter 6 we saw that products can act as emotional stimuli in different ways, depending on the person's focus (i.e. product as an object, agent or event). The role of the variable product-focus in the patterns of eliciting conditions had to be identified.



- (2) The second question was related to emotions that are not differentiated by central appraisal and concern types. For example, both *contempt* and *indignation* stem from an appraised illegitimacy. What is the variable that differentiates the patterns of eliciting conditions of these emotions?
- (3) The third question was related to the three emotions that did not have a proposed appraisal and concern type (i.e. *desire*, *inspiration* and *amusement*). Do these emotions involve appraisal and concern types other than those proposed, or can they be categorised in one of the four categories of emotions?

### Measuring product appraisals

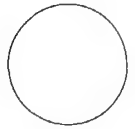
Because appraisals are not objectively observable or measurable, anyone interested in measuring appraisals has to rely on the subjective report of the person experiencing the emotion. The research literature reports three empirical approaches for this type of investigation, i.e. based on the use of emotion words, scenarios, or stimuli.

(1) *The use of emotion words.* Participants can be presented with emotion words, and asked to describe why, when, and how a product would elicit these emotions. The advantage of this approach is that the research can be focussed specifically on those emotions that are of interest to the researcher. Smith and Ellsworth (1985), for example, asked participants to recall past experiences of 15 distinct emotions, and to rate these experiences on some appraisal types. One shortcoming of the current research is that the reports might represent general rather than product-specific appraisals. This problem can be circumvented by first asking the participant to recall one or more products that elicited the given emotion. Subsequently, participants can base their description on the eliciting conditions of these recalled cases. A second shortcoming of this approach is that participants may not accurately remember the details of their appraisals, particularly when the emotion was experienced some time before the report.

(2) *The use of emotion scenarios.* Scenarios can be constructed in which specific characteristics of a product-person encounter (in terms of the model's key variables) are varied systematically. Subsequently, readers of such scenarios can be asked to indicate how the described person is likely to have felt, or how they would have felt themselves in the respective situation (see e.g. Roseman, 1991). The advantage of this approach is its ability to include all possible combinations of the key variables that make up the eliciting conditions. The main disadvantage of this approach is that it may introduce a high degree of artificiality because there is no independent evidence concerning the emotion that would actually be experienced.

(3) *The use of emotion stimuli.* Participants can be exposed to stimuli and their emotional responses towards these stimuli measured. Subsequently, participants can be asked to report why these emotions were experienced. This paradigm differs from the other two in that the appraisal process is assessed while the emotion is





being felt. Folkman and Lazarus (1985), for example, studied emotions experienced by students during a university examination. The advantage of this approach is that the short time-lapse between the experienced emotion and the reported appraisal reduces the risk of artefacts. The main disadvantage of this approach is that, since emotional responses to products are difficult to predict, an extensive product collection would be required to ensure a full overview of the 14 relevant emotions.

Besides the particular strengths and weaknesses, an important concern with all three paradigms is that one may question the extent to which participants report their personal appraisals, or whether they base their report on cultural knowledge or folk theory concerning emotion antecedents (Scherer, 1988). Scherer stressed that this threat is less serious when the reporting of the appraisal occurs within the emotional situation or just afterwards. Therefore, for the current study, it was decided to adopt an 'ecological' approach that combines the advantages of Paradigms 1 and 3. Participants have been provided with emotion words but, instead of asking them to report *remembered* appraisals, they were asked to report *actual* appraisals. Participants were instructed to photograph products that elicit the given emotions in their home environments, and to report –directly after taking the photo– the appraisal that preceded these emotions.

## Method

### Participants

33 Dutch people, between 25 and 36 years old, volunteered to participate in this study.

### Apparatus and material

All participants were provided with a booklet and a photo-film. The booklet contained 21 pages. On the first page, a set of ten emotions was printed. The remaining 20 pages provided space for the participant's rationales (each page for comments on a single photo).

### Procedure

The goal and procedure of the task were explained in a written introduction. Participants were instructed to photograph (at least) 10 products, each one of which elicited one of the given emotions. These ten given emotions had been randomly picked from the total set of 14 product emotions. It was stressed (and explained) that the task was concerned with (a) emotions elicited by the design of the product (and thus not by using or owning the product), which they (b) personally experienced (c) at the time of making the photo. Furthermore, participants were instructed to note down in the booklet the following information for each case: which product was



Figure 7-2 Examples of appraisal cases of Study 9.



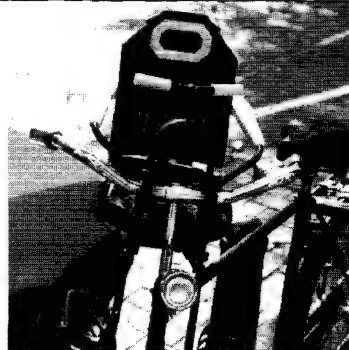
**Case number:** 0337

**Product:** telephone

**Participant number:** 21

**Emotion:** Disgust

**Why this emotion was experienced:** This product is very ugly, the shape is like a heap of slush.



**Case number:** 0234

**Product:** bike seat

**Participant number:** 09

**Emotion:** Desire

**Why this emotion was experienced:** My mother had a seat like this on her bicycle. It reminds me of the times when I was young. I desire those times

photographed, what emotion this product elicited, and why that particular emotion was experienced. They were asked to formulate their explanation (rationale) as completely as possible. They were invited to describe whatever they thought was relevant to explain their emotion (e.g. context, product design, associations, etcetera). The task was performed over six weeks of the participants' own time. Given Mitsubishi's interest, 15 participants were instructed to include at least five car models in their submitted cases.

## Results

Twenty-nine participants completed the task and each submitted between 10 and 15 cases. Consequently, the results of Study 9 comprised 384 cases, which filled an anecdotal database of product appraisals. Each case includes a picture of a product, a participant number, an emotion, and a description of the underlying appraisal. In analysing the results, 27 cases were left out of consideration because of missing or meaningless appraisal descriptions (e.g. "I desire this product because I want to have it"). Hence, the discussion of the results is based on 357 cases. Figure 7-2 shows two example cases, and Table 7-2 shows how the cases distribute over the emotions.

The rationales were studied to determine if the postulated appraisal and concern types could be identified. For each case, as well as the appraisal and underlying concern, the product focus was determined. Although the determination required subjective interpretation, this interpretation was done systematically by scanning the rationales for particular words. Concern and appraisal types could be determined on the basis of particular words. Words such as *should*, *ought to*, *right*, *wrong*, and *justified* refer to a standard concern and an appraisal of legitimacy. Words such as *like*, *nice*, *ugly*, *beautiful*, *love*, and *hate* refer to an attitude concern and an appraisal of appealingness. Words such as *want*, *need*, *would like to*, *do not want*, and *yearn* refer to a goal concern and an appraisal of motive compliance. Words such as *strange*, *unexpected* and *odd* refer to an expectation and an appraisal of novelty. The

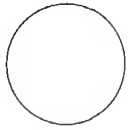


Table 7-2 Number of cases resulting from Study 9.

Pleasant emotions		Unpleasant emotions	
Emotion	Number of cases	Emotion	Number of cases
Inspiration	29	Disgust	32
Desire	31	Indignation	21
Pleasant surprise	21	Contempt	25
Amusement	20	Unpleasant surprise	20
Admiration	24	Dissatisfaction	22
Satisfaction	34	Disappointment	23
Fascination	30	Boredom	25

product focus could be determined by inferring the 'object of emotion' that is mentioned in the rationales (see also Section 1.2 in Chapter 1).

Comparison of the cases leading to the same emotion established the general pattern of eliciting conditions for the given emotion. In the discussion of the results, example cases are reported to reflect the diversity of the participants' narrative descriptions. Note that because the study was explorative the discussed patterns of appraisal conditions should be considered indicative rather than definitive.

The cases are discussed for each emotion separately. Although discussed separately, the emotions are grouped in accordance with their proposed central appraisal type (see Table 7-1). The three emotions that do not have a proposed central appraisal type (i.e. *desire*, *inspiration* and *amusement*) are discussed in Section 7.7.

## 7.3 Appealingness emotions

### Disgust

From Darwin onwards disgust is included in almost every list of basic emotions (Rozin, Haidt, & McCauley, 2000). Darwin related disgust to "something revolting, primarily in relation to the sense of taste." He placed the mouth and eating at the core of disgust, as have basic emotion researchers since then (Rozin & Fallon, 1987). They regard disgust as a guardian of the mouth, and therefore as a guardian of the physical body. Unsurprisingly, the elicitors of this 'basic' disgust are claimed to be food and its potential contaminants (Rozin, Millman, & Nemeroff, 1986).

If we look at the product emotion cases, only two of the 32 cases match this view on disgust. The first involves a garbage can with mould on the lid; the second a 'snack-wall' a fast food outlet that distributes fried snacks. Although both involve potential physical contamination, they are not strong cases of product disgust because the emotion is not elicited by the products' design (but rather by the mould and the unhealthy snacks). Moreover, the other 28 cases do not involve any potential



**0323 Ford Scorpio**

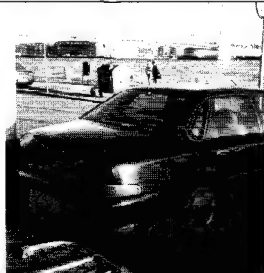
*Emotion* Disgust

*Comments* Very ugly; the backside is too long and too ungainly.  
This car is too overdone; not modest but very caddish.

*Focus* Object; the product's design.

*Concern* Attitude; I dislike overdone design.

*Appraisal* This car's overdone design is indigestible.



**0022 Lamp**

*Emotion* Disgust

*Comments* This lamp is kitsch with glass; fake baroque.  
Very distasteful.

*Focus* Object; the product's design.

*Concern* Attitude; I dislike fake products.

*Appraisal* This lamp's fake baroque design is indigestible.



**0133 Computer speaker**

*Emotion* Contempt

*Comments* This arrogant product has a giant mouth, with little content. It looks like it is an enormous gasbag.

*Focus* (Product as) agent; the product's personality.

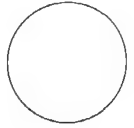
*Concern* Social standard; one should be modest.

*Appraisal* The products lack of modesty, displayed by its gasbag appearance, is inferior.



threat of physical contamination at all. In the **Ford Scorpio** case, for example, no physical risk of contamination is detectable.

It seems that disgust for products is not on the same level as 'basic' disgust. Ortony et al. (1988) emphasised that emotions that involve relatively little cognition usually have metaphorical analogues that involve much more. These analogues are what they call 'higher order derivatives.' This observation appears to apply to product disgust. The cases show that product disgust is generally a metaphorical disgust; it is elicited by products that are indigestible or distasteful – not literally but metaphorically. Product disgust is as straightforward as basic disgust: all cases show products 'as such' that correspond with a dislike (attitude). In some cases, the emotion is elicited by a design aspect, such as proportion, colour, a particular line or shape etc. In other cases, the disgust is elicited by the product's style or overall appearance, (e.g. kitsch or old-fashioned, as in the **lamp** case).

**Table 7-3 Pattern of eliciting conditions for disgust.**

Product focus	Concern	Appraisal
Object – the product's design	Attitude – dislike	The product's design is indigestible

All rationales of the disgust cases include aesthetic judgments, and in particular the word "ugly" or "distasteful." In the context of product disgust, the food vocabulary (taste, distaste, indigestible) has come to indicate general aesthetic judgements (see also, Rozin et al., 2000).

#### Conclusion

Clearly, product disgust is the result of a negative outcome of the appraisal type 'appealingness' (i.e. "this product is unappealing"). In the case of disgust this negative outcome specifies "this product is indigestible." The product focus is the object 'as such,' and the involved concern is some attitude (dislike). Table 7-3 shows the pattern of eliciting conditions that resulted in disgust. Note that although in the previous chapter disgust was the only emotion that was recognized as an appealingness emotion, in Section 7.7 it will be argued that desire can also be an appealingness emotion.

## 7.4 Legitimacy emotions

Contempt; admiration; indignation

### Contempt

Many emotion psychologists consider the emotion *contempt* as a social emotion (e.g. Izard, 1977). Ekman and Friesen (1975), for example, stated that contempt can only be felt for people. Izard and Ekman and Friesen agree that an essential characteristic of contempt is the belief that another person is *inferior* to oneself. Products are not people, and it seems unlikely that we feel contempt towards products because we regard them as inferior to ourselves. Nevertheless, in four of the 25 product cases this very appraisal appears to occur. In the **computer speaker** case, for example, the inanimate speaker was judged as if it were animate, as if it had the freedom to express itself. Consequently, it was appraised as violating a standard that normally applies to humans (one shouldn't be arrogant). This finding accords with the hypothesis of Ortony et al. (1988) that, in some cases, inanimate objects may be construed as animate and will therefore elicit social emotions. The three remaining cases involved products that were claimed to look 'dumb' or 'stupid' or 'arrogant'. The standards involved are the same as the social standards that apply to humans. For example, the reported standards included "one should be modest," "brave," or "powerful."

In all other cases, contempt was not directed towards the product itself but towards



**0363 Garden chair**

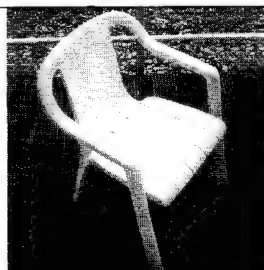
*Emotion* Contempt

*Comments* Only people who don't care about the quality of life use this chair.

*Focus* (Associated) agent; the action of the owner.

*Concern* Social standard; one should care about the quality of life.

*Appraisal* The owner's lack of caring for the quality of life, displayed by owning this chair, is inferior.



**0123 Singing Christmas tree**

*Emotion* Contempt

*Comments* What an invention. Who thinks of something like this; a singing Christmas tree! What a wasteful product in our consumption society.

*Focus* (Associated) agent; the action of the designer.

*Concern* Product standard; products should not be useless or superfluous.

*Appraisal* The designer's action to create a product as useless and superfluous as this singing Christmas tree, is inferior.



**0081 Glasses**

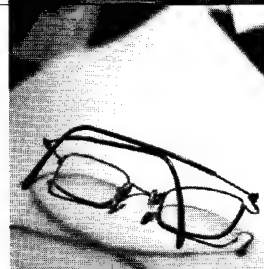
*Emotion* Admiration

*Comments* The glass of these glasses is beautifully shaped: not too dominating, and still expressive. Fantastic details, super simple and fitting.

*Focus* (product as) agent; the product's personality.

*Concern* Standard; one should be expressive yet not dominating.

*Appraisal* The product's modesty, displayed by its expressive yet not dominating appearance, is superior.



**0183 Smart**

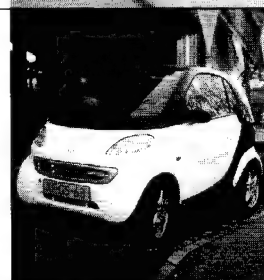
*Emotion* Admiration

*Comments* Beautiful car. This car has been innovatively designed.

*Focus* (Associated) agent; the action of the designer.

*Concern* Standard; products should be innovative.

*Appraisal* The designer's success in creating a car with a design that is this innovative is superior.



some agent associated with the product. This associated person can be either the owner or the person who designed, manufactured or sold the product. An example of the first kind is the **garden chair** case, in which the associated agent is the chair's owner. An example of the second kind is the **singing Christmas tree** case, in which the associated agent is the tree's designer. In both cases the contempt was both

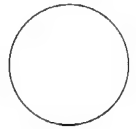


Table 7-4 Pattern of eliciting conditions for contempt.

Product focus	Concern	Appraisal
Agent – the product's personality	Standard	The product's personality is inferior
Agent – the action of the owner		The action of this product's owner is inferior
Agent – the action of the designer		The designer's action that resulted in this product is inferior

elicited by an action of a person associated with the product and directed at that person.

Ortony et al. (1988) postulated that contempt (and admiration) *always* involves some standard. The product contempt cases are consistent with this postulation. The **speaker** and **chair** cases involve social standards, related to the actions of people. Other reported examples include: "one should not be lazy," or "one should not be arrogant." The **Christmas tree** case involves a product standard, that is, a standard of how products should be or perform. Reported examples are: "products should not be superfluous," "caddish," "unoriginal," or "illogical."

#### Conclusion

Contempt was hypothesised to be the negative outcome of the appraisal of legitimacy. This hypothesis is supported by the product cases. Moreover, the cases illustrate that, to result in contempt, the outcome 'the product is illegitimate' specifies that 'the product or some agent associated with the product is inferior.' Table 7-4 shows the pattern of eliciting conditions that resulted in contempt.

#### Admiration

Admiration can be seen as the opposite of contempt. Whereas contempt is elicited by the appraisal of *inferiority*, admiration is elicited by the appraisal of *superiority*. Not surprisingly, admiration is elicited by the action of an agent that is appraised as matching some social or product standard. In the case of product contempt, we saw that not only humans but also inanimate products can be construed as being an agent. The same observation applies to 7 of the 24 cases of product admiration. For example, in the case of the **glasses**, the product is considered animate and is consequently appraised on the basis of a social concern (one should be expressive yet not dominating).

In 17 cases, the emotion is elicited by actions of people who are associated with the product. Of these, the description of 15 cases refers to an agent that is held responsible for creating the product (either a company or a designer; see the **Smart** case). Examples of statements in the participants' rationales, that refer to the action of the designer, are "designed properly," "smart design solution," and "good design."



**0069 Citroën BX**

*Emotion* Admiration

*Comments* I admire the vision of those who once bought this car. At that time it was ugly, but now it is beautiful (obviously, for me, the design was too progressive).

*Focus* (Associated) agent; the action of the owner.

*Concern* Standard; one should be visionary.

*Appraisal* The owner's progressive vision, displayed by buying this car, is superior.



**0316 Alessi dental floss container**

*Emotion* Indignation

*Comments* I've had it with this kind of products. Alessi floods the market with funny thin gummies to cheer up life. It is superfluous, useless, and most of all unauthentic.

*Focus* (Associated) agent; the action of the company.

*Concern* Standard; one should sell authentic products.

*Appraisal* The company's action to flood the market with such 'funny thin gummies' is offensive.



**0201 Ford Ka, special edition**

*Emotion* Indignation

*Comments* Who came up with the idea to attach such horrible big pieces of plastic to this car (bumper, spoiler, striping)? It is very ugly, and should not have been done. The car was better off without them.

*Focus* (Associated) agent; the action of the designer.

*Concern* Standard; designers shouldn't mutilate a design.

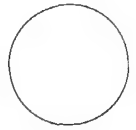
*Appraisal* The designer's action to stick these big pieces of plastic on a car, is offensive.



In the two remaining cases admiration is directed towards the product's owner (e.g. the **Citroën BX** case).

Although each case involves a standard, the types of standard vary strongly. The appraised superiority is based on the construed success of the product, designer or owner in meeting these standards. The greater the accomplishment the stronger is the admiration. This means that the more improbable it is that the agent will meet the standard, the more this agent is admired when (s)he succeeds. This explains why most of the standards mentioned by the participants are not easy to achieve (e.g. products should be "timeless" or "authentic"). More 'modest' standards, such as "products should perform their primary function" (which are relevant to, for example, disappointed) do not play a role in evoking admiration. Obviously, no one will admire a product for doing what it is supposed to do.



*Table 7-5 Pattern of eliciting conditions for admiration.*

Product focus	Concern	Appraisal
Agent – the product's personality	Standard	The product's personality is superior
Agent – the action of the owner		The action of this product's owner is superior
Agent – the action of the designer		The designer's action that resulted in this product is superior

#### Conclusion

Whereas the central appraisal outcome of contempt is 'this product is illegitimate,' the outcome resulting in admiration is the opposite: 'this product is legitimate.' The product cases exemplify that, to result in admiration, this general appraisal outcome specifies that: 'the product or some agent associated with the product is superior.' Table 7-5 shows the pattern of eliciting conditions that resulted in admiration.

#### Indignation

In his discussion of emotions, Lazarus (1991) defines indignation as a special type of anger. According to Lazarus, anger –and consequently indignation– is always elicited by the action of some agent. To be more precise, anger is experienced when some agent's action results in harm or threat to one of our standards. This assertion can be observed in all 21 product indignation cases: as with product contempt, each involves a standard and the action of an agent. See, for example, the case of the **dental floss container**. In this case, the participant is not indignant about the object as such, but rather with the company for the action of selling it. The company's action conflicts with the participant's standard of authenticity. Other reported standards include "functionality," "quality," and "originality."

According to Lazarus (1991, p. 223), a necessary condition for experiencing indignation is that "control must be attributed to whomever we blame for the concern frustration." When an agent is thought not to be in control of his actions, no blame can logically be assigned to them. If, however, it is thought they were capable of acting otherwise, they are likely to be blamed. The case of the **Ford Ka special edition** illustrates this 'control attribution.' In the opinion of the participant, the 'mutilated' design was the result of the action of a designer who was in control of his design actions. Had the participant believed that the designer had no choice, he would not have felt indignation.

#### Conclusion

The appraisal pattern of indignation resembles that of contempt. Both emotions are the result of a negative outcome of the appraisal of legitimacy. Nevertheless, they



**0310 Citroën Xsara**

*Emotion* Disappointment

*Comments* I think this car is boring. That is disappointing because Citroën has proved in the past to be able to create daring car designs.

*Focus* (Associated) agent; the action of the company.

*Concern* Interest goal; I want car design to be daring.

*Appraisal* Regretting that this car model is not as daring as I anticipated.



**0333 Scooter**

*Emotion* Disappointment

*Comments* When I noticed this scooter, I was instantly attracted because it looked like a really nice old scooter. However, closer examination revealed that it is a fake, retro design. It is not as authentic as it looks.

*Focus* (Associated) agent; the action of the designer.

*Concern* Interest goal; I want scooters to be authentic.

*Appraisal* Regretting that this scooter is not as authentic as I anticipated.



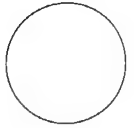
differ in the specific character of the appraised illegitimacy. Whereas contempt requires the appraisal outcome of stimulus *inferiority*, indignation requires an outcome of stimulus *offensiveness*. Product indignation always implies a sense of 'having been wronged.' Participant rationales include reports of being "treated less well than deserved," or being "demeaned." This appraisal of offensiveness illustrates that indignation involves some awareness of injustice: "how dare someone do this to me." A second (but related) difference is that *all* indignation cases involve the action of the person who is considered to be responsible for the product, whereas contempt can be elicited by *any* agent (product, owner or designer). Table 7-6 shows the pattern of eliciting conditions that resulted in indignation.

## 7.5 Motive compliance emotions

Disappointment; dissatisfaction; satisfaction

### Disappointment

In consumer research literature, disappointment, dissatisfaction and satisfaction are regarded as typical post-purchase emotions: one buys a product and is subsequently satisfied, dissatisfied or disappointed, depending on one's expectations and the product's performance. To imagine how these emotions are elicited by product appearance is somewhat less obvious. It may seem odd to suppose that emotions can be elicited by products *before* they are bought – simply by their appearance. Nevertheless, the product cases show that perceiving a product can be sufficient for

**Table 7-6 Pattern of eliciting conditions of indignation.**

Product focus	Concern	Appraisal
Agent – the action of the agent responsible for the product	Standard	This unsatisfactory product offends me (and the agent should have done better)

experiencing these three emotions, and in fact, several patterns of eliciting conditions can be identified.

According to Ortony et al. (1988), disappointment is a response to the disconfirmation of an anticipated goal satisfaction. This appraisal consists of two components. First, one anticipates that some goal will be facilitated (e.g. tomorrow the weather will be nice). Second, the actual stimulus disconfirms this anticipated goal (the next day it was actually raining). In short, disappointment is elicited when the anticipated goal satisfaction is not realised. The cases show that this definition applies to product disappointment. The case of the **Citroën Xsara**, for example, exemplifies the twofold disappointment appraisal. First, the participant anticipated that the Citroën Xsara would facilitate his need for daring design. Second, this anticipation was disconfirmed by the actual car's design, which was boring rather than daring. This example demonstrates that, contrary to what might be expected, products can facilitate goals in pre-purchase situations. These goals are what Ortony et al. (1988) labelled 'interest goals,' that is, things one wants to see happen (e.g. I want the sun to be shining, I want my favourite soccer team to win). In the above example, the participant has an interest in daring car design. Other reported interest goals are: "I want products to be "original," "solid," "sober," etcetera.

A central element in the appraisal that results in disappointment is the *anticipation*, or expectation. In the Xsara case, this anticipation was based on presumptions about the Citroën brand. Ten other cases showed similar anticipations that were based on prior knowledge. The remaining fifteen cases exemplify that this 'before encounter anticipation' is not a necessary condition for product disappointment. In these cases, the anticipated goal facilitation was based on some element of the object itself. See, for example, the case of the **scooter**. The scooter's overall appearance was responsible for the participant's anticipation of authenticity. Hence, one aspect of the product (overall appearance) induced an anticipation about another aspect (the product's authenticity). The other 14 cases followed the same procedure, for example, the case of a design chair. This case involved a participant with an interest in 'elegant design.' On first encountering the chair, he was delighted by the elegance of its shape. However, closer examination revealed that the chair was clumsily made. As this clumsy construction was detrimental to the elegance of the chair, the participant was disappointed.



**0125 Oven**

*Emotion* Dissatisfaction

*Comments* I'm dissatisfied because to me it is unclear how this oven is operated. This oven is user-unfriendly and therefore probably not safe.

*Focus* Event; the anticipated consequence of using this oven.

*Concern* Accomplishment goal; I want to be safe.

*Appraisal* The lack of user-friendliness of this oven is unacceptable.



**0314 Lemon squeezer**

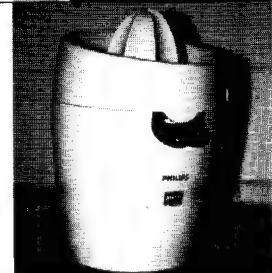
*Emotion* Dissatisfaction

*Comments* This is a really nice squeezer. I am dissatisfied however because it is probably very difficult to clean. There are many small hidden corners, which are difficult to reach. This is dissatisfying given the high price of this product.

*Focus* Event; the anticipated experience of using this squeezer.

*Concern* Accomplishment goal; I want an squeezer that is easy to clean.

*Appraisal* The difficulty to clean this squeezer is unacceptable.



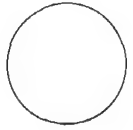
**Conclusion**

Disappointment was hypothesised to be elicited by an appraisal of 'motive incomplicancy.' However, given that *all* product disappointment cases include an *expectation mismatch*, it shows that this is not the only relevant appraisal type. In addition to being appraised as motive incomplicant, disappointment is also preceded by a novelty appraisal (in terms of unexpectedness). Therefore, the central appraisal of product disappointment is: "the product is (against expectations) motive incomplicant." The product cases exemplify that, to result in disappointment, this general appraisal outcome specifies to: "regret that this product was not designed to match my interest as much as I anticipated." Table 7-7 shows the pattern of eliciting conditions that resulted in disappointment.

**Dissatisfaction**

It is not difficult to come up with an example of product dissatisfaction. Imagine discovering that your new alarm clock does not produce enough sound to wake you up in the morning. As the clock does not fulfil its function, you might very well be dissatisfied. Although it seems a clear example, it is invalid because it is referring to an emotion elicited by using the product. You would probably not have been dissatisfied about this clock *before* using it. How is it possible to be dissatisfied with a product without using or owning it?

In the discussion of product disappointment, we saw that this emotion is preceded by an appraisal of motive incomplicancy. The same applies to product dissatisfaction.

**Table 7-7 Pattern of eliciting conditions for disappointment.**

Product focus	Concern	Appraisal
Agent – the action of the agent responsible for the product	Interest goal	I regret that the product was not designed to match my interest as much as I anticipated.

The difference between these two emotions is that, whereas disappointment is the result of the disconfirmation of an anticipated goal fulfilment, dissatisfaction is the result of an *anticipated goal frustration*. This proposition is illustrated by the example of the user-unfriendly **oven**.

Each time we encounter a product, we anticipate the future use or possession of that product. We predict what the experiences and consequences of using and owning this product will be. We anticipate the goals or needs that the product will fulfil. When we see a Ferrari, for example, we imagine the status that owning and driving it will give us. Similarly, we anticipate the goals or needs that the product will *obstruct*. The participant is dissatisfied with the oven because he anticipated that the oven would accord with his need for safety.

All dissatisfaction cases involve products that are appraised as conflicting with some goal or need. Reported examples are: "I want a camera that is understandable," "I want a pair of scissors that are comfortable," "I want a car that looks serious" A central feature of the appraisal is a sense of 'unacceptability.' See, for example, the case of the **lemon squeezer**.

The participant is dissatisfied because (s)he finds it unacceptable that this product is difficult to clean. As he anticipates that the squeezer will not satisfy his needs, he decides that he 'won't settle for this.' This appraisal feature contains a central aspect of the dissatisfaction appraisal: the *awareness of alternative outcomes* (see Abelson, 1983). One is only dissatisfied about an anticipated mismatch if one is aware that a match is feasible. An obvious example is the participant who was dissatisfied by a computer-case because the design was dull. He explicitly mentioned that he wonders why it wasn't possible to design a more interesting computer case, since he was aware that another computer company (Apple) had succeeded in doing so. If he had not been aware of the alternative outcome, that indeed it is possible to create a nice-looking computer, he would not have been dissatisfied.

#### Conclusion

Dissatisfaction is elicited by an anticipated goal mismatch (see table 7-8). The central appraisal of 'motive incomplicancy' specifies: "this product's inadequate goal fulfilment is unacceptable." Note that the same appraisal probably applies to



**0022 Volkswagen New Beetle**

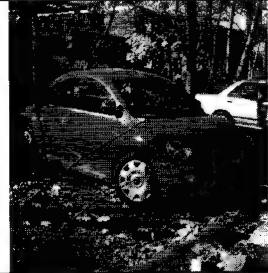
*Emotion* Satisfaction

*Comments* I am satisfied because I like the devilish round top of this car. It has the same look and feel as the original model.

*Focus* (Associated) agent; the action of the company.

*Concern* Interest goals; I want car design to be devilish.

*Appraisal* This car looks as devilish as I anticipated it.



**0045 Telephone**

*Emotion* Satisfaction

*Comments* I'm satisfied because it is exactly what a telephone should be: solid and simple, no unnecessary buttons.

*Focus* Event; the anticipated experience of using the telephone.

*Concern* Accomplishment goal; I want a telephone that is simple to use.

*Appraisal* The telephone is as solid and simple as a telephone should be.



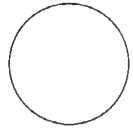
dissatisfaction elicited by using or owning the product. However, whereas 'post-purchase' dissatisfaction will be elicited by an actual mismatch, 'pre-purchase' dissatisfaction is elicited by an anticipated mismatch.

### Satisfaction

From a linguistic point of view it seems logical, on the one hand, to assume that satisfaction is the opposite of dissatisfaction. On the other hand, most emotion psychologists (see e.g. Ortony et al., 1988) assume satisfaction to be the opposite of disappointment. The product satisfaction cases suggest that –for products– both interpretations are legitimate. The cases show two possible patterns of eliciting conditions; one opposite to the pattern of disappointment, and one opposite to the pattern of dissatisfaction.

The first type of product satisfaction is elicited by the *confirmation of an anticipated goal facilitation*. See, for example, the case of the **Volkswagen New Beetle**. In this case, the participant has an interest in mischievous design; he wants car design to be radical. Moreover, he anticipated that the New Beetle would match his interest. Consequently, when he found that the Beetle did indeed match this interest in radical design, he was satisfied. Like disappointment, the novelty appraisal plays an important role in the appraisal pattern of satisfaction. Whereas disappointment involves an expectation *mismatch*, satisfaction involves an expectation *match*.

The second type of product satisfaction is elicited by *anticipated goal facilitation*



**Table 7-8 Pattern of eliciting conditions for dissatisfaction.**  
**Table 7-9 Patterns of eliciting conditions for satisfaction.**

Product focus	Concern	Appraisal
Event – the anticipated experience or consequence of using the product	Accomplishment goal	This product's inadequate goal fulfilment is unacceptable

Product focus	Concern	Appraisal
Agent – the action of the agent responsible for the product	Interest goal	This product was designed to match my interest as much as I anticipated
Event – the anticipated experience or consequence of using this product	Accomplishment goal	Anticipating that this product will facilitate my goal

(e.g. the **telephone** case). An 'accomplishment goal' of the participant is to have a telephone that is simple to use. He is satisfied by the photographed telephone because (based on the product design) he anticipates that it will facilitate this goal. Like dissatisfaction, this emotion can be characterised as an anticipatory emotion; it is elicited by an anticipated product use experience or consequence. This second type of product satisfaction is represented by cases involving products that elicit satisfaction because they 'provide what one wants them to.' Compare this with the first type, which is represented by cases involving products that elicit satisfaction because they 'are how one wants them to be.'

#### Conclusion

The two types of product satisfaction are both the result of an appraisal of motive compliancy. Satisfaction is elicited either by anticipated goal facilitation or by the confirmation of anticipated goal facilitation. Table 7-9 shows the two patterns of eliciting conditions that resulted in satisfaction.

## 7.6 Novelty emotions

Pleasant surprise; unpleasant surprise; boredom; fascination

### Pleasant Surprise

According to Scherer (1984, 1988) unvalenced surprise requires an appraisal of novelty as a necessary and sufficient condition. In his view, surprise requires a novelty appraisal both in terms of suddenness and unexpectedness. Ortony et al. (1988) offer an explanation for the difference between *unvalenced* and *pleasant* surprise. They propose that whereas unvalenced surprise is elicited by novelty as such, pleasant surprise involves an *unexpected concern match*.

All 21 product cases involve this unexpected concern match. See, for example, the



**0198 Note clip**

*Emotion* Pleasant surprise

*Comments* I am pleasantly surprised because this note clip is actually made of real wood. That is a remarkable idea, and I like the authenticity of the natural wooden twigs.

*Focus* Object; the product's material.

*Concern* Attitude; I like authentic natural materials.

*Appraisal* I didn't expect this clip would be made of real tree twigs.



**0306 Volkswagen Passat**

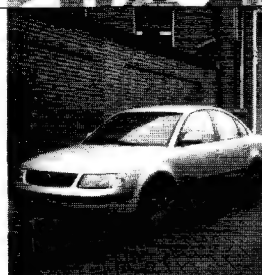
*Emotion* Pleasant surprise

*Comments* I am pleasantly surprised because after years of producing boring (yet reliable and solid) Passats, Volkswagen finally created one that is both reliable and solid, AND looks attractive.

*Focus* (Associated) agent; the action of the company.

*Concern* Standard; products should be attractive and reliable.

*Appraisal* I didn't expect Volkswagen (after years of boring Passats) to market a Passat that is both reliable and attractive.



**193 Hand chair**

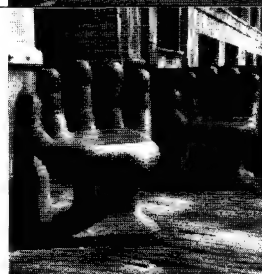
*Emotion* Unpleasant surprise

*Comments* This chair is amazingly overdone; the opposite of elegance. I had no idea that chairs could be this hideous.

*Focus* Object; the product's design.

*Concern* Attitude; I like elegant chairs.

*Appraisal* I didn't expect a chair could be this hideous.



case of the **note clip**. The participant has an attitude for natural materials. In this particular case, he had not anticipated that the clip would be made of real twigs. The pleasant surprise was therefore elicited by the sudden and unexpected discovery of the match between the clip and his attitude for natural materials. In some cases the appraisal involves active expectations. In these cases, the pleasant surprise is elicited by the 'violation of an expected concern mismatch.' See, for example, the **Volkswagen Passat** case. Based on experiences with previous Passats, the participant expected the car to conflict with his standards of attractiveness and reliability. The actual car model suddenly violated this expectation by corresponding instead of conflicting with this standard. The resulting emotion was pleasant surprise. Another example is a participant who expected his cheap alarm clock to be of low quality (given the low price), yet instead it proved to be of high and durable quality. The mismatch expectation can be based on previous experiences with products of the same type, brand, appearance, etcetera.



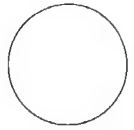


Table 7-10 Pattern of eliciting conditions for pleasant surprise.

Product focus	Concern	Appraisal
Object	Goal	The product unexpectedly (and suddenly) matches a concern or The product (suddenly) violates an expected concern mismatch
Event	Attitude	
Agent	Standard	

### Conclusion

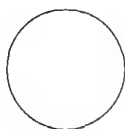
Surprise is elicited by an appraisal of novelty (both in terms of suddenness and unexpectedness). Although necessary, this appraisal of novelty is not enough to elicit *pleasant* surprise. It is only when the appraisal is supplemented with either an appraisal of 'motive compliancy', 'legitimacy', or 'appealingness' that the resulting surprise will be pleasant. The involved concern can be of any type. The cases show examples of standards (e.g. "products shouldn't be able to hurt you"), goals (e.g. "I want to relax"), and attitudes (e.g. "I like elegant shapes"). The central appraisal outcome of 'the product is novel,' specifies: the product 'unexpectedly matches a concern,' or 'violates an expected concern mismatch.' Table 7-10 shows the patterns of eliciting conditions that resulted in pleasant surprise.

### Unpleasant Surprise

The general principles of pleasant surprise elicited by product design also apply to unpleasant surprise. We have seen that two types of product pleasant surprise can be distinguished; one elicited by an unexpected concern match (i.e. the product unexpectedly corresponds with a concern), and one by the violation of an expected concern mismatch (i.e. the product was expected to conflict with a concern but in fact it corresponded with that concern).

The same types can be distinguished in the 20 unpleasant surprise cases. An example of the first type is the **hand chair** case. In this case, the participant had no expectation about the hand chair. He simply had no idea that chairs this 'hideous' could exist. The chair mismatched one of his cognitive dispositions about what chairs should look like. Moreover, it conflicted with his attitude for elegance. Other examples of this type of unpleasant surprise were: "the rear end of this car was unexpectedly weak" (standard), or "the product was unexpectedly clumsy" (goal).

An example of the second type is the **jerry can** case. In this case, the participant expected the product to match his concern of comfortable usage, and he was unpleasantly surprised when he found that in fact the jerry can was not at all comfortable to use.



**0004 Oil jerry can**

*Emotion* Unpleasant surprise

*Comments* This jerry can has an extensible nozzle – which is supposed to be comfortable. However, to extend the nozzle the user must insert his fingers and try to get a grip on the slippery nozzle which is very difficult – and uncomfortable.

*Focus* Event; the product's use.

*Concern* Goal; I want comfortable usage.

*Appraisal* I didn't expect this extensible nozzle, which is supposed to be comfortable, to be this uncomfortable.



**0042 Nutcracker**

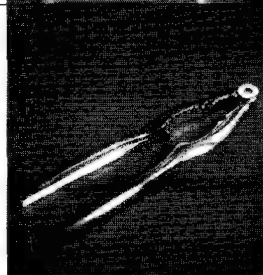
*Emotion* Boredom

*Comments* Yes, this is a nutcracker. Period. It is prototypical, and that is all it is. In other words, it is more of the same.

*Focus* Object; the product's design.

*Concern* Need; the need to explore.

*Appraisal* This nutcracker's design is not stimulating.



**0042 Disk container**

*Emotion* Boredom

*Comments* I've seen this product in one brief glance. After that, it is not worth looking at anymore, because there is nothing to see (dull colours, shapes, and materials).

*Focus* Object; the product's design.

*Concern* Need; the need of bodily sensations.

*Appraisal* This container's design is not stimulating.

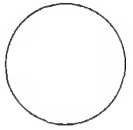


### Conclusions

Like pleasant surprise, the central appraisal of unpleasant surprise is the appraisal of novelty (both suddenness and unexpectedness). Not surprisingly, the outcome of unpleasant surprise requires a supplemented appraisal of 'motive incomppliance,' 'lack of appeal,' or 'illegitimacy.' Again, the involved concern can be of any type. The central appraisal outcome 'the product is novel,' specifies to: the product 'unexpectedly mismatches a concern,' or 'violates an expected concern match.' Table 7-11 shows the patterns of eliciting conditions that resulted in unpleasant surprise.

### Boredom

It is a well-established psychological principle that people are 'intrinsically' motivated to seek and maintain an optimal level of arousal (Hebb, 1955; Berlyne, 1971). A shift away from this optimal level (both increase or decrease) is unpleasant. Since low arousal levels seem to be disliked, we appear to have "stimulus hunger" (Bexton



**Table 7-11 Pattern of eliciting conditions for unpleasant surprise.**

Product focus	Concern	Appraisal
Object	Goal	The product unexpectedly (and suddenly) mismatches a concern <i>or</i> The product (suddenly) violates an expected concern match
Event	Attitude	
Agent	Standard	

et al., 1954). A lack of stimulation leads to the emotion *boredom*. This simple rule can be detected in all 25 product boredom cases (e.g. the **nutcracker** case).

One important source of stimulation is a stimulus mismatch with our cognitive dispositions (knowledge, expectation). As novel stimuli tend to mismatch these dispositions, they require our cognitive assimilation apparatus to find or construct matching dispositions (Frijda, 1986). Therefore, these 'interesting' stimuli stimulate us. On the other hand, products that match our cognitive dispositions make no call upon our capacity for cognitive assimilation and are therefore not stimulating. This source of product boredom can be detected in 15 of the 25 product boredom cases. In these cases, the product is appraised as not stimulating because it is 'more of the same' and leaves nothing to explore (see the nutcracker case above).

The remaining 10 cases are similar because they also involve a lack of stimulation. The reason they are appraised as not stimulating, however, is somewhat different. For example, some products are reported to elicit boredom because "the colour is dull." It seems unreasonable to assume that colours are either stimulating or dull by reason of cognitive assimilation. In these cases, products elicit boredom because they do not provide *sensory* stimulation (see Frijda, 1986). An example of this type of product boredom is the **container** case.

These cases elicit boredom because the products conflict with the need of 'bodily sensations'. According to Ford (1992) the need of bodily sensations represents the physical and sensory experiences that one would like to have. This need is related to the sensation-seeking motive, which was extensively investigated by Zuckerman (1979). The concern of sensation-seeking refers to the motivation to undertake risky activities and to obtain strong sensory or sensual experiences. The rationales accompanying these cases include words such as "the product is nothing," "idea-less," and "not worth looking at."

#### Conclusion

Boredom was hypothesised to be elicited by an appraisal of novelty. Indeed, boredom requires the product to be appraised as 'not novel but *familiar*.' Although



**0159 Electric toothbrush**

**Emotion** Fascination

**Comments** This product has a nice elegant shape and is beautifully detailed. The casting combines hard and soft plastic. That feels nice and is fascinating.

**Focus** Object; the product's design.

**Concern** Need; the need of exploration.

**Appraisal** My attention is caught by the unusual combination of soft and hard plastic in one shape.



**0288 Volkswagen New Beetle**

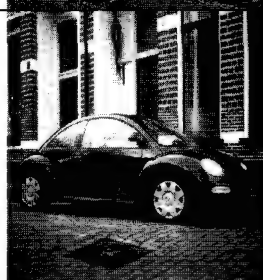
**Emotion** Fascination

**Comments** I find it interesting that Volkswagen markets a new and restyled version of the Beetle many decennia after the original release. I wonder what their strategy is to do so.

**Focus** (Associated) agent; the company's action.

**Concern** Need; the need of understanding.

**Appraisal** My attention is caught by the question why Volkswagen restyles a famous car after many decennia of the original release.



necessary, this appraisal seems to be insufficient to explain product boredom. Familiarity 'as such' is not unpleasant but unvalenced (see also the discussion on pleasant and unpleasant surprise). A product can be familiar in a pleasant and in an unpleasant way. Note that we are surrounded with many products with which we are familiar but not yet bored. Hence, the appraisal of familiarity requires further specification to explain product boredom. The boredom cases show that products elicit boredom when they are appraised as not stimulating, either on a cognitive or on a physical, sensory level. Therefore, it seems that boredom arises when pursuing the need of stimulation *combines* with this appraisal of familiarity to an unpleasant experience of familiarity. In this sense, product boredom differs from the emotions discussed so far because it is related to a particular concern instead of concern types.

As with pleasant and unpleasant surprise, the product focus is *unspecified*. Although the example cases show boredom elicited by the product as an object, some associated agent, or some anticipated experience or consequence of use could also elicit boredom. Table 7-12 shows the pattern of eliciting conditions that resulted in boredom.

### **Fascination**

In the analysis of product boredom the 'need to explore', which is the need to 'change the unknown into the known,' was discussed (Ford, 1992). If products leave nothing to be explored, they are considered dull and elicit boredom. Logically, in the opposite way, products that meet our need of exploration are found to be

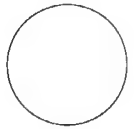


Table 7-12 Pattern of eliciting conditions for boredom.

Product focus	Concern	Appraisal
Unspecified (object, agent, or event)	Need – the need of stimulation (either through exploration or bodily sensations)	This product is not stimulating (or, not worth attending)

fascinating. These products mismatch our cognitive dispositions and therefore require us to find or construct matching dispositions. This process of cognitive assimilation requires us to explore the product, and this explains our fascination. Sixteen of the 30 product fascination cases involve this need to explore (e.g. the **electric toothbrush** case). These cases refer to objects that are novel, unexpected, or complex. According to Frijda (1986), fascination is related to the concern of curiosity. In his view, curiosity is one of our basic human needs and the need to explore is a specification of this need for curiosity.

The 14 remaining cases are also related to this need for curiosity. They differ from the other 16 cases in the sense that fascination is not elicited by objects as such, but by questions awakened by these objects. For example, in the case of the **Volkswagen New Beetle**, the participant is fascinated by a question related to the Beetle. This question touches upon what Ford (1992) distinguishes as 'the need of understanding.' The need of understanding reflects a "desire to acquire knowledge in the deeper sense of constructing elaborated, intellectually satisfying representatives of personally meaningful phenomena" (Ford, 1992, p. 90). Questions posed in the participants' rationales include, for example, "why was this designed?" "How does this work?" "What is it?" "How was it made?" and so on.

The need of exploration differs from the need of understanding in terms of the involved cognitive process. Perusing the need to explore requires the relatively superficial process of observation and discovery. Perusing the need to understand requires this process to be supplemented by "processes of reasoning, interpretation, or analysis" (Ford, 1992, p. 91). Nevertheless, although different, both need types can be seen as refinements of the basic need of curiosity.

### Conclusion

As in the case of product boredom, fascination is not related to a concern type but to a particular *given* concern: the need of curiosity. Moreover, in the discussion of product boredom we saw that an appraisal of familiarity is necessary, but is not sufficient to explain how products elicit boredom. A similar discussion applies to product fascination. Although the central appraisal of 'unfamiliarity' is necessary, it is



**0022 Kangaroo ball**

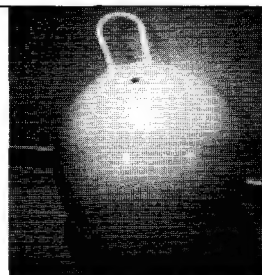
*Emotion* Desire

*Comments* The emotion desire is evoked by the association of the activity of using the product. The thought of playing with the kangaroo ball makes me desire to have fun.

*Focus* Event; the anticipated experience of using this kangaroo ball.

*Concern* Need; the need of entertainment.

*Appraisal* Anticipating that playing with this kangaroo ball will be fun.



**0022 Shoehorn**

*Emotion* Desire

*Comments* I like the simple shape and sensual red colour.

*Focus* Object; the product's appearance.

*Concern* Attitude; I like sensual shapes.

*Appraisal* The shoehorn's sensual shape is delighting.



not sufficient to explain product fascination. The cases show that products elicit fascination when they are appraised as matching the need of curiosity. Product fascination therefore arises when the need of curiosity combines with an appraisal of unfamiliarity to generate a pleasant sense of unfamiliarity. Again, like boredom, the focus type of product fascination is unspecified. Fascination can be experienced towards the product itself, some associated agent, or some anticipated experience or consequence of use.

## 7.7 Remaining emotions

Desire; inspiration; amusement

### Desire

According to Frijda (1986, p. 283) desire is "engendered by the thought of, or encounter with, a fit object not in possession, and when such possession seems to call for." Thus, desire is elicited when a product is recognized as *potentially* beneficial for some concern. The 31 product desire cases demonstrate that, although product desire always involves this 'recognition of a fit object,' the way in which this recognition manifests varies. The recognition of a fit object can manifest itself through a positive outcome on one of three central product appraisal types (i.e. the product is 'motive compliant,' 'appealing,' or 'legitimate'). Based on these underlying appraisal types, three product desire types can be distinguished: desire of *consequence*, desire of *presence*, and desire of *identity*.

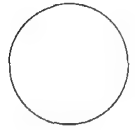


Table 7-13 Pattern of eliciting conditions for fascination.

Product focus	Concern	Appraisal
Unspecified (object, agent, or event)	Need - the need of curiosity (either through exploration or understanding)	My attention is caught by (some question about) the product (or: the product is worth the investigation)

#### Desire of consequence

In the discussion of product dissatisfaction, we saw that this emotion is elicited by an *anticipated* goal obstruction. One can be dissatisfied with a small vacuum cleaner because one anticipates it will not clean adequately. In a similar way, we can anticipate that a product will facilitate a goal. For example, when we see a Ferrari, we can anticipate the status owning and driving it will provide for us, and this fantasy might elicit desire. Similarly, one might anticipate that a particular product would satisfy the need of status, relaxation, entertainment, or fulfil the goal of efficiency or safety.

The product cases show that the anticipated use or consequences of use can be strong emotional stimuli. In the case of the **kangaroo ball**, it is not the kangaroo ball 'as such', but the anticipated experiences associated with using it that elicits the desire. Sixteen product desire cases fit this appraisal pattern, in which the concern is always some goal or need. In addition to the need of entertainment, examples of reported needs are stimulation, relaxation. Reported goals are, for example: "I want to be sexy," "to have fun," and "to be sociable." In all these cases the participants construe the product as *promising* for fulfilling that particular goal or need.

#### Desire of presence

In 10 product desire cases, participants report products to be desirable simply because they find these products beautiful. In those cases, desire was not elicited by the appraisal of 'motive compliancy' but by the appraisal of 'appealingness.' In the case of the **shoehorn**, the participant's desire is based on an attitude: a dispositional liking for sensual shapes. The shoehorn is desirable because it matches this concern. Frijda (1986) argues that sometimes inherently pleasant stimuli (such as bright colours and sweet tastes) can elicit desire. Therefore, products can bring us sensory delight that is desirable in itself. In these cases, possession is called for because we prefer to be surrounded with products that offer this sensory delight. Following this line of thought, the desire of presence can be seen as desiring the object in order to *retain* the experienced sensory delight. In other words, the difference from the desire of consequence is that the desire is not directed towards an anticipated consequence but towards the act of perceiving the product itself. This desire 'for beauty' is what some researchers typify as 'aesthetic desire' (see, for example, Lazarus, 1991).



**0220 Peugeot 406 coupé**

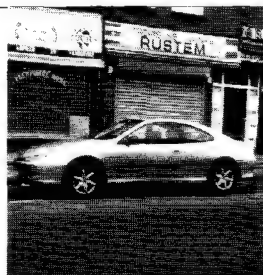
*Emotion* Desire

*Comments* I think this car is very cool. I look at this car and wish that I was like that; I guess I wish I were as cool as this car.

*Focus* (Product as) agent; the product's personality.

*Concern* Goal; I want to be cool.

*Appraisal* This car is as cool as I would like to be myself.



**0237 Newson chair**

*Emotion* Inspiration

*Comments* This chair holds many interesting elements. Simple yet complex shapes, inside-outside relationship, the suggestion of a personality, the sensual shapes. This inspires me because it functions as the starting-point for my own thoughts and ideas.

*Focus* Object; the product's design.

*Concern* Need; the need of intellectual creativity.

*Appraisal* I'm infused with new thoughts by the conceptual and visual richness of this chair's design.



### Desire of identity

The remaining five product desire cases appear to have been elicited by an appraisal of 'legitimacy'. In these cases, participants report desire that is related to a personal identification with the product. These cases resemble the 'social desire' we sometimes experience towards people we admire. In those cases we desire to be that person, or to have his or her admirable characteristic. The same type of desire seems to apply to products when the participants feel desire for the product's anthropomorphised identity (e.g. the **Peugeot 406 coupé** case).

Apparently, we can 'resonate' with products as if they were somehow people. In those cases not the product as such, nor its anticipated consequence, but rather the product's identity or character is the object of desire. In Section 6.3, we saw that a person's self-ideal represents a special class of standards. In the case of 'desire of identity' the appraisal of legitimacy is based on this type of standards. Cupchik (1999, p. 76) proposed that "an object can be seen by the user to resonate with and be symbolic of the self." This idea matches the research of Belk (1988, 1989), who argued that we establish our identity through the products we surround ourselves with. Consequently, we buy products that remind us of who we are or who we want to be.

### Conclusion

The definition of desire proposed by Frijda (1986) applies to all product desire cases: a product elicits desire when it is appraised as 'a fit object that calls for possession.' In other words, the central appraisal of product desire can be described as 'object



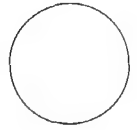


Table 7-14 Pattern of eliciting conditions for desire.

Product focus	Concern	Appraisal
Event – the anticipated product use	Goal	using or owning it will fulfil a need or goal
Object – the product's design	Attitude	The product is a fit object that calls for possession its design is delightful
Agent – product's personality	Standard – self-ideal	because: its personality expresses the some desirable quality or characteristic

fitness.' An important finding was that this appraisal is endorsed by either an appraisal of 'motive compliancy,' 'appealingness,' or 'legitimacy.' Consequently, although desire is always targeted at a product as an object, it can also be elicited by the product's personality, or the anticipated event of using the product. In other words, the 'object fitness' can refer to fitting some attitude, *or* some standard, *or* some goal.

To summarise, three related types of product desire arose from the cases. First, the desire for 'getting it,' which is a desire for some anticipated benefit. Second, the desire for 'keeping it,' which is a desire for prolonging or retaining a benefit. Third, the desire for 'being it,' which is a desire for being or having some identified characteristic or quality. Table 7-14 shows the patterns of eliciting conditions that resulted in desire.

### Inspiration

To breathe into, to be filled, to inflame – these are the meanings of the Latin 'inspirare', which seems a likely etymological origin for inspiration. In ancient inspired creativity, the Muses are described as whispering, breathing, or singing into the recipient. In this line of thought, the concept of inspiration is often related to the creative process (see Williams, 1982). In accounts of creativity, the moment of inspiration is seen as the moment of discovery that constitutes a breakthrough in the way we have been thinking about a problem, often described as "illumination" (May, 1975). Although the product cases show substantial variations in participants' explanation of why and how products elicit inspiration, this sense of illumination seems to be present in all 29 product inspiration cases. Reported experiences include the experience of being charged, stimulated, energized, infused, and uplifted.

Within the cases' variation three types of product inspiration can be distinguished, in which the aspect of illumination manifests in three different ways: in *thought*, *action*, or *awareness*. First, inspiring products are reported to infuse participants with new and creative thoughts or ideas (e.g. the **Newson chair** case). These eight cases



**0094 Cooking clock**

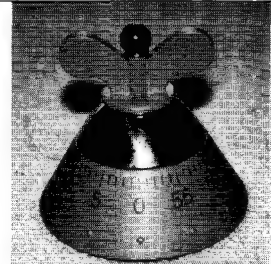
*Emotion* Inspiration

*Comments* Although this clock has a functional and decent expression, the enthusiastic hat reminds me of my love for cooking and inspires me to start cooking.

*Focus* Object; the product's design.

*Concern* Need; the need of self-expression.

*Appraisal* I'm stimulated to cook by the clock's uplifting character.



**0051 Watch**

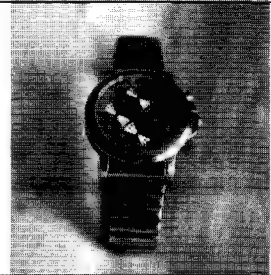
*Emotion* Inspiration

*Comments* Because the output is very simple and straightforward – the time, while at the same time, the internal mechanism is very complex. This tension field between complexity and simplicity represents an always-returning theme of life. I find that inspiring.

*Focus* Object; the product's design.

*Concern* Need; the need of transcendence.

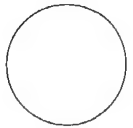
*Appraisal* I'm uplifted by the tension field between simplicity and complexity that is represented by this watch.



represent the above mentioned 'classic' view on inspiration, in which the illumination is related to personal creativity. Reported experiences include: "ideas start bubbling," "my head starts working," "I feel creative," etcetera.

In other cases, the participants do not report being infused with new and creative ideas but rather are stimulated to begin some activity or behaviour (e.g. the **cooking clock** case). In these cases, the illumination manifests itself through a renewed sense of some loved facet of one's identity (e.g. hobby, field of expertise, or skill). Moreover, the participant is stimulated to behave in a way that takes advantage of or challenges this facet. The cooking clock did not infuse the participant with a creative idea, but it did remind her that she loves cooking and thus stimulated her to cook. Similar cases report being stimulated to play sport, solve puzzles, party, etcetera. In those six cases, the illumination has the form of a renewed sense of one's personal identity.

Both product inspiration types described above can manifest into *form*, either in ideas or (the tendency to) actions. These cases can be described as a 'light bulb' of an idea popping up. Hart (1998) distinguishes a second way in which illumination can manifest – into *being*. Rather than in the form of an idea or action, illumination takes the form of a shift in perspective. According to Hart, in those cases, inspiration affects our 'general state of consciousness.' In the case of the **watch**, for example, the participant reports an *uplifting* experience that is the result of the shift in perspective caused by the watch. This shift is associated with what Ford (1992) describes as the need of 'transcendence.' According to Ford (p. 91), this is the universal need to "go

**Table 7-15 Pattern of eliciting conditions for inspiration.**

Product focus	Concern		Appraisal
	Need – the need of intellectual creativity		it infuses me with new thoughts or ideas
Unspecified (object, event, agent)	Need – the need of self-expression	The product is illuminating, because:	it stimulates me to some action or behaviour
	Need – the need of transcendence		it is uplifting

beyond the ordinary thoughts and feelings of everyday life and transcend to some sort of high or peak experience." The remaining 14 product inspiration cases show that sometimes products can match this need by lifting us above the ordinary. In some of those cases participants report a sense of "connectedness," "completeness," "understanding," "brilliance," or a feeling of "awe." Although the cases are very diverse, they all refer to some uplifting experience.

#### Conclusion

None of the four product appraisal types appears to manifest in the evoking conditions of product inspiration. Instead, inspiration is elicited by an appraisal of 'illumination.' The cases show three ways in which this appraised illumination can manifest: into new thoughts, into an action, or into a more general shift of perspective. Like the 'novelty' emotions (i.e. pleasant and unpleasant surprise, boredom, fascination), the product focus is unspecified. Inspiration can be elicited by the product as such, an associated agent, or some anticipated experience or consequence. Table 7-15 shows the pattern of eliciting conditions that resulted in inspiration.

#### Amusement

What makes a product amusing? Amusement is an emotion generally denoted as a response to *humour* (Ruch, 1993). The debate on the nature of humour has a long and elaborate history (see e.g. Goldstein & McGhee, 1972). Researchers who study humour seem to agree that a humorous stimulus always contains *incongruous* elements (Ruch, 1992). This incongruity is essentially unexpected and initially perplexing.

All 20 product amusement cases show these incongruous, contradictory, or ambiguous elements. In the case of the **motorised bike with child seat**, for example, the participant found the combination of a motorised bike and a child seat unexpected and illogical, and therefore funny.



**0131 Motorised bike with children seat**

*Emotion* Amusement

*Comments* The combination of the elements: a gasoline motor and a children seat is funny. What kind of person is using this?

*Focus* (Associated) agent; the user's behaviour.

*Concern* Need; the need of cognitive mastery.

*Appraisal* The unexpected combination of a gasoline motor and a children seat is funny.



**0200 Coffee clock**

*Emotion* Amusement

*Comments* Funny to use a real coffee cup as the housing for a clock. This must be a kitchen-clock!

*Focus* Object; the product's design.

*Concern* Need; the need of cognitive mastery.

*Appraisal* The unexpected combination of a coffee cup's picture and a clock is funny.

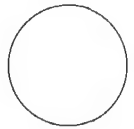


Note that although necessary, incongruity is not a sufficient condition for amusement. Incongruity can also lead to other emotions. The unusual combination might also have fascinated or even frustrated the participant. Hence, as well as incongruity, amusement appraisal requires a second element. Rothbart (1973) introduced this twofold appraisal as the 'challenge-mastery sequence.' According to Rothbart the basis of amusement is the sudden overcoming of a cognitive challenge. In other words, the initial element of incongruity is supplemented by a subsequent element in which the incongruity is *resolved*. Although some effort is required, in the end one discovers that the incongruity makes sense from another perspective. See, for example, the case of the **coffee clock**. At first, the participant can't make sense of the use of a coffee cup to house a clock. However, as soon as the idea is formed that this clock must have been designed especially for the kitchen, the illogical combination makes sense: the incongruity is resolved.

**Conclusion**

Although none of the four central appraisal types are adequate to explain amusement, an appraisal of novelty appears to be necessary. Incongruity implies novelty, in terms of unfamiliarity or unexpectedness. Given the 'challenge-mastery sequence' discussed above, this general appraisal specifies to: "some initial product incongruity is solved." The product focus is unspecified. Incongruity can be construed in objects as such (see the coffee clock case), in some agent's behaviour (see the motorised bike case), or some associated consequence.

A complication of the emotion amusement is that it seems difficult to find an under-

**Table 7-16 Pattern of eliciting conditions for amusement.**

Product focus	Concern	Appraisal
Unspecified (object, agent, or event)	Need – the need of cognitive mastery	Some initial product incongruity is solved (but does not disappear)

lying concern type. What exactly is the concern touched upon when we are amused? As opposed to the participants' rationales, which offer few clues (see the two examples above), Frijda (1986) proposes a solution. He argues that the basic human concern of 'cognitive mastery' underlies the experience of amusement. Table 7-16 shows the pattern of eliciting conditions that resulted in amusement.

## 7.8 Discussion

Study 9 was designed to investigate the eliciting conditions of a set of 14 emotions. Four 'appraisal types' drawn from the appraisal literature were proposed to play a central role in the eliciting conditions (see Table 7-1). The main aim of the study was to investigate how these general appraisal types must be modified or specified to differentiate the 14 emotions. In the study, it was found that for each emotion one or more unique underlying appraisals could be identified. Moreover, the results indicated that each of the 14 emotions is the outcome of a unique (i.e. emotion-specific) 'pattern of eliciting conditions,' which includes, besides the particular appraisal, information about the concern involved and information about how the product operates as an emotional stimulus.

As the patterns are discussed extensively in the sections dealing with results, the current section is restricted to a discussion of how the general appraisal types were specified to emotion-specific appraisals and a discussion of the experimental design.

For each of the 14 emotions the cases that resulted from Study 9 were investigated. In this investigation it was found that the way in which the general appraisal types specify to emotion-specific appraisals differs between the emotions. For five emotions (a), a refinement of the proposed appraisal types was sufficient. For four emotions (b), the proposed types needed to be supplemented with other appraisal types. Five emotions (c) appeared not to be elicited by any of the four proposed appraisal types but by other types of appraisal.

(a) *Appraisal type refinement.* A relatively simple refinement of the postulated appraisal type was sufficient to define the appraisals that elicit disgust, contempt, admiration, indignation, and dissatisfaction. Table 7-17 shows how the postulated appraisal types were refined to emotion-specific appraisals.

**Table 7-17 Appraisal refinement.**

Emotion	Postulated appraisal type	Emotion specific-appraisal
Disgust	Unappealing	The product is indigestible
Contempt	Illegitimate	The product is inferior
Indignation	Illegitimate	The product is offensive
Admiration	Legitimate	The product is superior
Dissatisfaction	Motive inconsistent	The product is unacceptable

*Note.* The emotion-specific appraisals in this table are abridged versions of those defined in Tables 7-3 to 7-16.

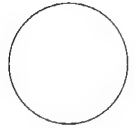
(b) *Appraisal type supplement.* For four emotions, a simple refinement of the postulated appraisal type appeared to be insufficient. The appraisals that elicit these emotions were defined by supplementing the postulated appraisal type with one of the other types. This kind of appraisal specification was done for pleasant and unpleasant surprise, disappointment, and satisfaction. Table 7-18 shows the postulated types, those that were supplemented, and the emotion-specific appraisals finally proposed. The table shows that the appraisal of disappointment is partly similar to the appraisal of unpleasant surprise. The appraisals of these two emotions differ with respect to the element of suddenness. It is this element of suddenness that differentiates the patterns of eliciting conditions of unpleasant surprise and disappointment.

(c) *New appraisal types.* Five emotions were not elicited by one of the four postulated appraisal types. Table 7-19 shows the postulated appraisal types and the proposed emotion-specific appraisals of these five emotions.

It was hypothesised that both fascination and boredom were elicited by an appraisal of novelty (respectively 'novel,' and 'not novel'). It was found that, although necessary, novelty is not the central appraisal of these emotions. Instead, they appear to require an appraisal of 'interest.' Boredom is elicited by a negative outcome, and fascination is elicited by a positive outcome of the appraisal of interest.

The eliciting conditions of all emotions discussed so far include concerns types, implying that the specific concerns within a type are interchangeable. The results indicate that, for some emotions, concerns within a concern type are not interchangeable. It was found that for four emotions the relevant concern has a determining effect on the differentiation between the emotional reactions. One-to-one relationships between specific concerns and individual emotions have been found for inspiration (the need of creativity, self-expression, or transcendence), and amusement (the need of cognitive mastery).

The pattern of eliciting conditions that results in desire is a special case. At first sight the eliciting conditions of desire cannot be described in terms of one of the four

**Table 7-18 Appraisal type supplement.**

Emotion	Postulated appraisal type	Added appraisal type	Emotion-specific appraisal
Disappointment	Motive inconformant	Novel (unexpected)	The product does not match a concern as much as was anticipated
Satisfaction	Motive conformant	Not novel (expected)	The product matches a concern as much as was anticipated
Pleasant surprise	Novel	Either motive conformant, or legitimate, or appealing	The product unexpectedly (and suddenly) matches a concern
Unpleasant surprise	Novel	Either motive inconformant, or illegitimate, or unappealing	The product unexpectedly (and suddenly) mismatches a concern

*Note: The emotion-specific appraisals in this table are abridged versions of those defined in Tables 7-3 to 7-16.*

general appraisal types. Instead, it is elicited when the product is appraised as 'a fit object that calls for possession.' A more detailed examination, however, revealed that this appraisal is a generalisation of three distinct appraisals. Desire can be elicited by three patterns, each involving another central appraisal type. Consequently, there are different types of product elicited desire (i.e. desire of consequence: motive consistency; desire of presence: appealingness; and desire of identity: legitimacy).

### Measuring product appraisal

Based on the results 14 unique patterns of eliciting conditions have been postulated. Because the design of Study 9 was explorative, the results do not warrant generalizability of these patterns. However, the similarity in the reported eliciting conditions is remarkable, indicating there is at least some level of face validity.

One important question is whether or not the comments of the participants represent actual product appraisals. As was mentioned in the introduction to this section, the danger is that participants use their cultural knowledge of prototypical appraisal processing in reconstructing their cognitive evaluation, beginning with their labelling of the emotional state. At this time it is still unclear to what extent appraisals enter awareness and can be readily verbalised by participants (Scherer, 2001). Consequently, this method may produce artefacts, in the sense that one taps stereotypical appraisal rather than 'real' appraisals.

One may also question whether participants clearly understood the differences between the emotions. Did the participant who indicated that he was inspired by the Apple iMac really experience inspiration, or was it actually fascination or admiration. The participants in this experiment were not trained to distinguish subtle differences

**Table 7-19 New appraisal types.**

Emotion	Postulated appraisal type	Emotion-specific appraisal
Boredom	Nor novel	The product is not worth attention
Fascination	Novel	The product is worth the investigation
Inspiration	-	The product is illuminating
Amusement	-	The product's initial incongruity is solved (but does not disappear)
Desire	-	The product is a fit object that calls for possession

between emotional experiences. On the other hand, the 14 product emotions are based on studies that aimed to compose a set of emotions that are unmistakably different (see Study 3 in Section 2.4). It is therefore safe to presume that the participants of Study 9 were able to report their emotional responses correctly,

### **Implications for the design practice**

The patterns of eliciting conditions indicate when and how products elicit particular emotions. It is important for designers to realise that the patterns proposed in this thesis are only indicative. These patterns should not be considered as formulas that will guarantee to lead to product designs that elicit the desired emotions. Instead, the function of these patterns is to illustrate that a designer must take all three key variables (i.e. appraisal, product focus and concern) into account when he or she aims to design products that elicit predefined emotions. The proposed patterns can be used by the designer as a starting-point for developing his or her personal sensitivity for recognizing the eliciting conditions of product emotions.

Note that patterns of eliciting conditions can be defined for *all* emotions. It is not claimed that the set of 14 emotions that was focussed on in Chapters 6 and 7 contains all emotions that can be elicited by product appearance. Rather it is expected that designers who understand the process model of product emotions (and understand how the three key variables combine to create patterns of eliciting conditions), can create such patterns themselves. Whether or not these patterns are generalisable is not an issue. It is more important that these patterns support designers in their attempts to 'design emotions' in the context of a given design project. In that sense, the creation of the patterns can be considered as a first *design* step in a design project, instead of something that is left to the responsibility of a 'design researcher.'

In Chapter 8 the step from research to design practice is made. The value of the process model of product emotions and the patterns of eliciting conditions for the design practice is evaluated, and a tool that aims to inspire and educate designers is described.



# 8: Designing product emotions



## 8.1 Introduction

All products are able to elicit emotions. Whether it is an expensive sports car or a simple clothes peg, they all have the potential to elicit some emotional response. In part B of this thesis, we saw that these emotional responses are influenced by the appearance of the product. In other words, products with different appearances elicit different emotions. Designers can manipulate the appearance of their products, and thus influence the emotions elicited by these products. Given this influence, designers have the opportunity to manipulate the emotional impact of the products they design. In other words, they can 'design emotions.'

Designers who intend to manipulate the emotional impact of their designs are confronted with the difficulty that, in most cases, there is not a one-to-one relationship between product appearance and elicited emotions. It is not possible to define simple design rules on the basis of relationships between product appearance characteristics (such as shape, colour, material) or product features, and emotional responses. The reason is that the emotion is not elicited by a particular shape, *as such*, but rather by the shape in relation to the concerns of the person who experiences the emotion. Nevertheless, in the previous two chapters we saw that, on the process level, it *is* possible to identify one-to-one relationships. The 'model of product emotions' shows that each emotion is elicited by a unique (and universal) pattern of eliciting conditions.

The question is, how may this model of product emotions support designers in manipulating the emotional impact of their designs. Although it does not offer design-rules, it does offer distinctions that can help designers in their understanding of how products elicit emotions. It was hypothesised that a designer who can define patterns of eliciting conditions (such as those described in Chapter 7) can use these patterns to 'get a grip' on the emotional impact of his or her product designs. Defining a pattern of eliciting conditions can be considered a first step in the design process.

To be capable of defining such patterns of eliciting conditions, the designer must first understand the model's key variables, i.e. concern, product focus, and appraisal. In addition, the designer must understand how these variables combine to form emotion-specific patterns of eliciting conditions. To that end, the [product & emotion] navigator was developed. The current, and final, chapter of this thesis describes the development and application of this tool, which is the second tool to be developed in this research. The tool's main aim is to familiarise designers with the model of product emotions. It visualises how the model's key variables combine to form patterns of eliciting conditions with the use of numerous anecdotal examples. In addition, the tool was designed to be inspiring and intuitive in use.



The design community was actively involved in the development and application of the [p&e] navigator through the organisation of two design workshops. While these did not involve empirical research but rather explorative design activities, it was decided to report these activities in this thesis. The reason for this is that the main target group of this research is the design community, and this work should thus ultimately result in knowledge and tools for designers. The workshops were therefore valuable because they exemplify attempts to apply the model of product emotions in design practice.

Section 8.2 reports on a workshop in which 57 designers used the model of product emotions to design 'body cleansers' that elicit predefined emotions. The main aim of this workshop was to discover if designers could define patterns of eliciting conditions and apply these patterns in a design project. Section 8.3 presents the [product & emotion] navigator, which was developed on the basis of the patterns of eliciting conditions proposed in the previous chapter, and the insights that were drawn from the 'body cleanser' workshop. Section 8.4 reports the application of the [p&e] navigator in a second workshop. This workshop's aim was to test if the [p & e] navigator provided designers with insights that would support them in their attempts to design a product that elicits pre-specified emotions.

## 8.2 Workshop 'body cleanser'

To be of value to designers, the model of product emotions should not only clarify emotions elicited by *existing* products, but should also be applicable to *new* (yet-to-be-designed) products. To assess the applicability of the model in a design context, a one-day 'designing emotion' workshop was organised in October 2000. Central to this workshop was the aim that the participating designers would design a product that elicited a predefined emotion, and that they would use the model to reach this target. Although the workshop does not allow us to reach definitive conclusions, it does indicate that the general patterns offered by the model of product emotions can be applied to a new design.

### Aim of the workshop

The workshop was designed to answer three questions.<sup>1</sup> First, is the model and its key variables comprehensible for designers? Second, does an understanding of the model enable designers to design a product that, in their view, will elicit a pre-specified emotion? Third, do designers evaluate the model and its application as a valuable and useful asset for their design practice?

### Participants

The workshop was hosted by the Dutch design agency Fabrique (Delft) in association with the Design & Emotion Society.<sup>2</sup> Fifty-seven designers participated (52 designers

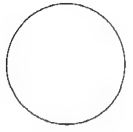


Figure 8-1 Impression of the 'body cleanser' workshop.



from the Dutch design agencies KVD (Amsterdam) and Fabrique, plus 5 selected design students). Seven design tutors coached the participants. All the coaches were familiar with the model of product emotions and had previous experience in coaching design workshops. A psychologist who specialises in emotion research was also present for further discussions on the subject of emotions.

#### Approach

A product elicits an emotion when it is appraised as either conflicting or corresponding with one of our concerns. The *nature* of the appraisal determines the *nature* of the ensuing emotion, and therefore each emotion is elicited by a unique appraisal. Hence, in a situation in which the emotion is given and the concern is specified, the product remains the only undetermined variable. Consequently, a designer should be able to design a product that elicits the predefined emotion, given that this designer understands the eliciting conditions of that predefined emotion.

Based on this idea, the one-day workshop's structure followed a two-step approach. In step one, the participating designers got acquainted with the general model and the eliciting conditions of a particular predefined emotion. In step two, based on the insights they acquired, they designed a 'body cleanser' that aimed to elicit the given emotion from a user with a specified concern. The term 'body cleanser' was explained as a category that included all products used to purify, wash, or clean (a part of) the body (e.g. a shower, a toothbrush, soap, or dental floss).

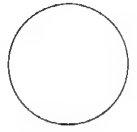
**Table 8-1 Appraisals created in the workshop 'body cleanser.'**

Emotion	Appraisal
Desire	The product creates the expectation that it will fulfil one of my needs .
Inspiration	The product stimulates me to a new kind of action.
Admiration	There is a paradox between complexity and simplicity, which makes the product superior.
Amusement	The product is stimulating in a way that is surprising, distracting, and self-confirming.
Satisfaction	There is a simple one-to-one relationship between the expectation one has about the product and what the product offers.
Fascination	The product holds the promise that it will fulfil my concern of knowledge, or understanding things.
Pleasant surprise	My expectations are disconfirmed in a positive manner.
Disgust	The product confronts me with something that I find distasteful.
Indignation	The product collides with my norms and standards, and shows no respect.
Contempt	In my eyes , the product is inferior (and I am not inferior).
Unpleasant surprise	The regularity is intervened by an unpleasant turn.
Dissatisfaction	The product does not do what it is supposed to do.
Disappointment	Something I expect and hope to happen, does not happen.
Boredom	You do not get the stimulation you're looking for.

### Part one

The workshop began with a plenary presentation, in which the model of product emotions and its key variables was explained and illustrated. With the use of some examples, it was demonstrated how each emotion is elicited by a unique appraisal. *To prevent bias in the second part of the program, only emotions not included in the set of 14 product emotions were used in the examples (e.g. 'hope,' 'pride,' 'relief').* The total group was divided into groups of four participants. Each group was given one of the 14 product emotions and asked to formulate the pattern of eliciting conditions for this given emotion in terms of the model's key variables. In order to ensure an open-minded exploration of the emotion's general eliciting conditions, none of the participants were aware of the kind of product they would be asked to design in the second part of the program. To determine the eliciting conditions of their assigned emotion, the participants followed a four-step approach.

- **Step a.** Generate a list of personal anecdotal product examples that elicit the assigned emotion. Each group member should do this exercise individually. These examples can be based both on recollection of past experiences and on products that are present in the workshop location.



- **Step b.** Discuss the produced examples with the other group members. For each anecdotal example, try to describe as accurately as possible why this particular product elicited the given emotion. Discuss with the group which concern might have played a role in your emotion. Remember that in the case of an unpleasant emotion the product has conflicted with your concern, while in the case of a pleasant emotion the product has corresponded with your concern. Discuss the examples of all group members.
- **Step c.** Explore the concerns that were mentioned in the discussion of the previous step and search for commonalities in these concerns. Investigate whether or not some particular concern or concern type reoccurs. If so, try to establish if the emotion is typically related to this concern (type).
- **Step d.** Based on the insights gained from the group discussion, attempt to formulate the appraisal that elicits your emotion. The aim of this exercise is to create a (product independent) one-sentence formulation of how a product is appraised to elicit the given emotion. This formulation should start with: "someone or something does something that ...," or "something happens that ...," or "there is something that ...." Use group discussion to formulate a sentence that captures the essence of the appraisal.

At the end of the first part of the program, each group had formulated an appraisal for their given emotion (see Table 8-1). The 14 groups were invited to briefly present their appraisals to the other participants. To give the participants feedback on their results, the appraisals that had been formulated beforehand (i.e. those reported in Chapter 7) were 'revealed' to the participants.

### Part two

Following the plenary presentation, it was announced that the aim of the second part of the program was to design a 'body cleanser.' The groups of four were then split up into 28 couples who were each provided with a particular concern (e.g. "I want to have more contact with my mother," "I want to be admired," "one should respect animals"). The couples were instructed to combine their appraisal with the given concern to a concern-specific pattern of eliciting conditions. They then began to generate ideas for body cleansers that fitted this pattern. A product was seen as fitting the pattern if, given the specified concern, it was appraised as eliciting the given emotion. At the end of this part of the program, each couple selected one of their ideas and prepared this idea for a plenary presentation.

### Results

The first part resulted in 14 presentation sheets, each visualizing a pattern of eliciting conditions of a distinct emotion (see Table 8-1). In the second part, 28 presentation



Figure 8-2 Examples of the 'body cleanser' workshop results.

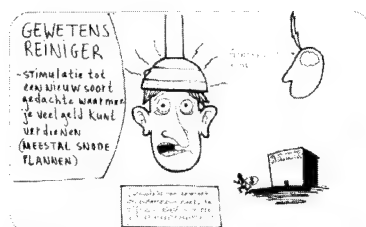
**A Ivory toothpick**

- Emotion** Contempt  
**Concern** One should not ill-treat animals  
**Appraisal** Someone does something that is below every standard  
**Concept** A tooth-pick made of ivory



**B Conscience cleaner**

- Emotion** Inspiration  
**Concern** I want to make a lot of money  
**Appraisal** Something stimulates me to new thoughts or ideas  
**Concept** This device cleans the conscience and therefore enhances the creativity in thinking of ways of making a lot of money without being restricted by regrets or remorse. Robbing a bank, for example, can be executed without conflicts of the conscience.



**C Ionic shower / exotic waterfall**

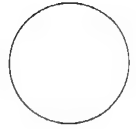
- Emotion** Boredom  
**Concern** I want life to be exciting  
**Appraisal** The product does not stimulate me in any way  
**Concept** Ionic shower: This shower requires no effort at all. You simply stand underneath it for ten minutes and you are completely cleaned. You don't have to undress or do anything else. Exotic waterfall: Bring the tropical forest in your bathroom. A detailed imitation waterfall. Very exciting... however, will it be after three weeks?



sheets were produced, each visualising a single product idea (each of the 14 product emotions was represented by two product ideas). Some examples of the product ideas created are depicted in Figure 8-2. Each example includes the given emotion and concern, the produced appraisal, and a description and drawing of the product idea.

## Discussion

This workshop was not a controlled experiment, but rather an exploration of how the model would work in a design project. The informal nature of the procedure that was followed did not allow for definitive conclusions regarding the applicability of the model of product emotions. Nevertheless, the informal evaluative discussions



allowed for some general observations regarding each of the three questions that were posed.

The first question was whether the model of product emotions had proved comprehensible for designers. The majority of the participants felt that by the end of the morning program they had a satisfactory grasp of the model's key variables, and the emotion specific patterns of eliciting conditions. This impression was supported by the remarkable resemblance between the reported appraisals and those that had been formulated beforehand. The use of product examples in the plenary introduction was reported to have been of great assistance. A frequent remark was that the active exploration of concrete anecdotal product examples to illustrate the general patterns (i.e. the morning program) had been helpful in making things clear.

The second question was, were the designers capable of designing a product that elicited a predefined emotion? Strictly speaking, answering this question would require an assessment of the emotions actually elicited by the designed body cleansers. This kind of study was not performed because the designs were based on a fictitious, 'one-dimensional' user who had only one concern. Nevertheless, although the actual success in designing the predefined emotion was not assessed, the confidence of the designers can be regarded as indicative. Most participants reported that they were quite confident that their product would indeed elicit the prescribed emotion. Moreover, in their presentation they were able to convince the other participants and the supervisors of this. The ability of the designers to defend their designs indicated that the model of product emotions supported their self-confidence in designing a product that elicits a predefined emotion.

The third and final question was, did the designers evaluate the model and its application as a valuable and useful asset for use in their design practice? On the one hand, the participants agreed that the model was both clarifying and inspiring. The general patterns of the model were seen as useful distinctions that would be applicable in design assignments. On the other hand, the workshop assignment was felt to be rather artificial because, in reality, an emotion is never the sole starting point of a design project. Moreover, some participants felt uncomfortable about designing a product that aimed to elicit an unpleasant emotion. Although it helped them to understand the process of product emotions, they stated that they would never aim to design a product that elicited an *unpleasant* emotion.

Some participants reported that the assignment to focus on a single emotion and concern had been too simple. The workshop experience might have been richer if the participants had been allowed to focus on more (mixed) emotions and on an intended user with a more realistic set of concerns.



### 8.3 The [product & emotion] navigator

The reports from the 'body cleanser' workshop indicated that the emotion-specific patterns of eliciting conditions represented by the model of product emotions could be of value for designers. The workshop also illustrated that it requires some effort to understand how the model's key variables combine into these patterns. Designers who want to incorporate the model into their design efforts must invest both time and energy to familiarise themselves with it. *The [product & emotion] navigator is an interactive tool that was developed to assist designers in understanding the model in an inspiring way. It was specifically designed to enable self-tuition. As the [p&e] navigator is included with this thesis, the reader is invited to explore its possibilities.*

In the workshop described in the previous section, familiarising the participants with the model of product emotions, using a step-by-step approach, took up the entire morning program. Although effective, an approach that requires such intensive coaching is time-consuming and, more importantly, is not suitable for self-tuition. An approach that does allow self-tuition is preferable because it would make the model accessible to the design community. The question is, can this model be made accessible in a way that does allow for self-tuition?

The most obvious approach would be through a verbal 'manual' or textbook. It would be reasonable to suppose that a designer who made the effort to conscientiously read Chapters 1, 6, and 7 of this thesis would be familiarised with the model at least as well as the workshop participants. However, this reading exercise would take *more* time than the workshop, and it is probably safe to assume that since a textbook is usually not a designer's preferred medium, this approach would cause many 'dropouts'. Given this consideration, the [p&e] navigator was developed as an inspiring alternative that is more accessible and more inviting.

#### Aim of the [product & emotion] navigator

The navigator's major aim is to familiarise designers (and anyone interested in how consumer products elicit emotions) with the model of product emotions. Moreover, the navigator aspires to do so in a way that fits the way of thinking of, and is appealing to, designers. In other words, the navigator aims to be stimulating by providing 'education through inspiration.' An important difference from a textbook is that it was designed to be open-ended, in the sense that the user is free to invest as much time as he or she wants. Because it requires effort to get acquainted with the distinctions, the more time one invests in exploring the navigator, the greater the understanding will be. Nonetheless, even a cursory exploration might be sufficient to stimulate ideas.



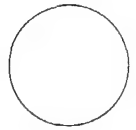
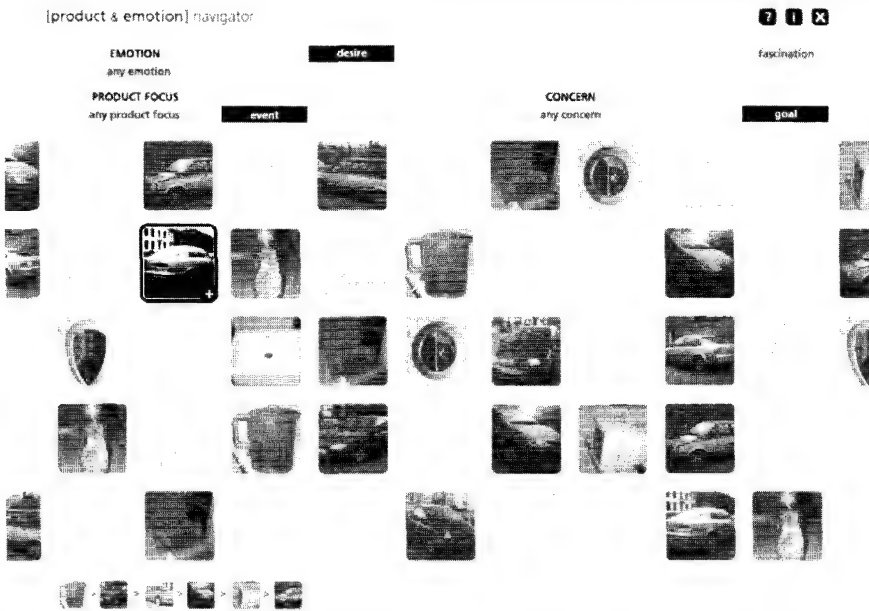


Figure 8-3 The [product & emotion] navigator interface.



### Concept

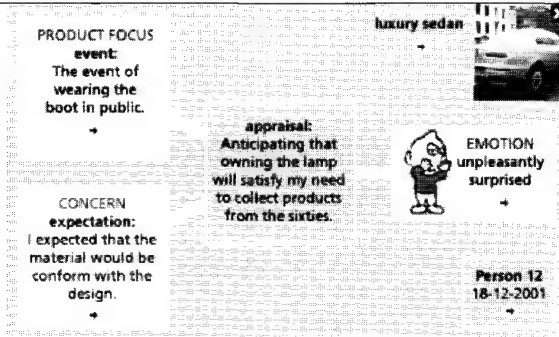
In the 'body cleanser' workshop, it was found that anecdotal examples were extremely useful for exemplifying the general patterns of how products elicit emotions. Therefore, the [p&e] navigator follows a similar strategy. The core of this interactive (computer) tool is an extensive field of product examples built from the 384 cases of Study 9. For each case, the eliciting conditions are available (in terms of appraisal, concern, and product focus). The user can navigate through the 'playfield' and examine the eliciting conditions of each single case. The central assumption is that, although each illustrative case is unique, in combination these cases illustrate the models' key variables and how these variables combine to form patterns of eliciting conditions. In a way, anyone who browses through the [p&e] navigator relives the iterative process that was followed in Chapter 7 to define the patterns of eliciting conditions.

### Navigation

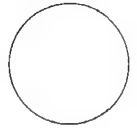
Central to the navigator is the way in which the user navigates through the playfield. This navigation is based on three major types of interaction: (1) focussing; (2) browsing; (3) viewing (see Figures 8-3 and 8-4).



Figure 8-4 The [product & emotion] viewer.



- 5 **Focussing.** The top part of the interface contains three sets of buttons. Each set represents one of the model's key variables (i.e. 'emotion,' 'concern,' and 'product focus'). With these buttons, the user can focus the 'playfield' on cases of his or her interest. For example, with the 'emotion' buttons, the 'playfield' can be focussed on cases that involve a particular emotion, such as *inspiration* or *boredom*. Similarly, with the 'concern' buttons, one can focus on cases that elicit an emotion on the basis of a particular type of concern, such as *standards*. Also, selections can be combined (e.g. emotion = *desire*, and concern = *goal*). The 'playfield' instantly highlights the relevant cases by fading those cases that do not meet the demands set by the focus buttons.
- 6 **Browsing.** A movable browser is visualised in the 'playfield'. This browser can be dragged and dropped on to any (active) case. With it, parts of the field that do not fit the interface can be made visible (only a small part of the field is visible on the computer screen). If the browser is dragged to the edge of the field, the field will shift to reveal hidden parts of the 'playfield'.
- 7 **Viewing.** A case can be selected using the browser. Once the selection has been made the browser transforms into a viewer. The pattern of eliciting conditions for the selected case is shown in this viewer (i.e. appraisal, concern, and product focus). Besides this information, the viewer also depicts the date on which the case was created and a person identification number. The emotion is represented by both a verbal label and a PrEmo puppet (see part B of this thesis). When the user has finished viewing the case he/she can transfer back into browser mode and browse to another case. Another option is to use one of the 'auto-browse-buttons.' These are the little arrow-buttons shown in the viewer. If the user clicks on the emotion button, the viewer will automatically browse to another case that elicits the same emotion. Similarly, the user can auto-browse on any of the other variables (*the product*: go to a case that includes the same product; *concern*: go to a case that includes an emotion that was elicited on the basis of the same concern; etcetera).



A history bar is visualised at the bottom of the interface, on which thumbnails of viewed cases are depicted. The user can return to any of these previously viewed cases simply by clicking on the corresponding thumbnail.

As the [p&e] navigator is intended to be an inspirational tool, the interface was designed to establish interaction that is perceived as challenging, persuasive, and elegant. The navigation is open-ended, i.e. it does not have a beginning, an ending, or a predefined search-path. One can, for example, use a particular emotion, a particular product, or any of the key variables as the point of departure for a navigator session. The essence of the navigator is the combination of two interaction types. The auto-browse function is based on intuition and on focussing on something of interest. The focussing function is based on a more rational type of interaction, and can be used for an in-depth investigation of a predefined question.

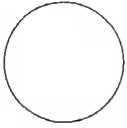
The [product & emotion] navigator components

In addition to the [p&e] navigator itself, the computer program contains two more components: an introduction ("about the [p&e] navigator"), and a short description of the model of product emotions ("[p&e] theory"). The 'about' component explains the aim of the [p&e] navigator and the basics of its interaction possibilities. The 'theory' component explains the basics of the model of product emotions. Both components are optional; the user is free to explore them. The theory component is mainly targeted at those who want to know more about the underlying theory. The 'about' component is targeted at those who have difficulty with the interaction or those who want to know more about the aim of the navigator.

## Discussion

Although the [p&e] navigator does not provide 'design rules,' it can assist designers in their analysis of emotions elicited by existing products, and offer clues on what user information is needed to incorporate emotional aspects into new designs. The navigator is the object of constant development. New cases are added and included cases are refined, based on new theoretical insights. Moreover, plans exist to create a growing web-version.

To find out if the [p&e] navigator fulfils its intended aim of providing 'education through inspiration', it was used in a second 'designing emotion' workshop, which is discussed in the next section.



## 8.4 Application of the [product & emotion] navigator

The [product & emotion] navigator was developed to be an inspiring educational tool. Its educational aim is to familiarise users with the general patterns of how products elicit emotions. To evaluate this tool, in December 2001 it was used in a second 'designing emotion' workshop. The participants in this workshop were asked to design products that elicited predefined emotions. In doing so, they applied insights they had gained from a navigator session. The workshop experiences were used to evaluate the [product & emotion] navigator. Using an evaluation form, the participants expressed their opinions regarding the navigator's strengths and weaknesses.

### Aim of the workshop

The workshop's major aim was to test the usability of the navigator and to discover if it fulfilled its purpose. First, it was designed to assess whether or not a navigator session enables designers to design products that elicit predefined emotions. Essentially, it should be possible to replace the previous workshop's morning session (which required intensive step-by-step coaching) with an autonomous navigator session. Second, and no less important, it was designed to discover if the designers found their interactions with the navigator *inspiring*. Special attention was paid to 'mixed emotions', because in the previous workshop it was found that designing a product that elicits a single emotion was too simple. In addition, (as in the case of the 'body cleansing' workshop) as the participants had all volunteered to take part, the workshop was designed to provide them with a pleasant and inspirational experience.

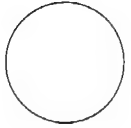
### Participants

The workshop was held at Delft University of Technology. The participants were 16 design students from the School of Industrial Design. They were enrolled from a group of students who had taken part in a design course that is available to fourth year students. They were coached by two design tutors.

### Approach

The workshop's approach was similar to that of the 'body cleansing' workshop. Using the distinctions included in the model of product emotions, the participants designed products that aimed to elicit predefined emotions. The one-day workshop was divided into two parts. In the first part, the participants got acquainted with the model of product emotions. In the second part, they applied their newly obtained insights in the design of products that aimed to elicit predefined emotions.

The major difference between the two workshops was that in the second workshop the morning program was replaced by a [p&e] navigator session. In addition to



this major difference, the workshop's structure was upgraded on four points. First, the products were designed to elicit *two* emotions instead of one. Participants were allowed to select these two emotions rather than having them prescribed. Second, instead of involving just one concern, the designs were based on a fictional user with a broad set of concerns. Third, instead of prescribing the product to be designed, the participants were allowed to select a product that they wanted to design. The fourth and final difference was that the second part of the program was more structured than that of the previous workshop.

### Part one

The workshop opened with a plenary presentation in which the model of product emotions and its key variables were explained. The workshop's program was also explained. The group of participants was then randomly divided into eight design couples. It was explained to these couples that the assignment was to design a product for a given user, and that the challenge was to design the product so that it elicited two predefined emotions. They were instructed to start by selecting two emotions (on the basis of their design interest).

To prepare themselves for the design assignment, the couples were instructed to create (1) a 'concern profile' of the targeted user, and (2) appraisals of two selected emotions. Instead of providing them with a set of predefined concerns, each couple was given a product & emotion space. This space (Figure 8-5) visualises a (fictional) user's emotional responses towards 17 consumer products.<sup>3</sup>

It was explained to the participants that in interpreting the map they should focus on the distances between products and emotions. For example, the 'Smart car' is located closer to *desire* than the 'tape dispenser.' This difference indicates that the car elicits more *desire* than the dispenser. Products that elicit similar emotional responses are positioned close to each other (e.g. the scooter and the lemon squeezer elicit similar emotions). Similarly, emotions that are positioned close to each other are often experienced together (e.g. the particular user often simultaneously experiences *inspiration*, *fascination* and *pleasant surprise*).

This product & emotion space was introduced to provide the designers with a richer and more realistic image of a user rather than with a set of predefined concerns. In principle, designers who understand the general patterns of how products elicit emotions should be able to distil user concerns from this map. The participants were instructed to formulate a set of concerns for the user. They were allowed to include as many concerns as they felt were needed, but it should include at least one standard, one taste, and one attitude. Note that the map allows for numerous different interpretations. Hence, it was anticipated that each participating couple would distil a different concern profile. This was not an obstacle because, although dissimilar,

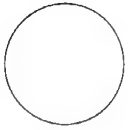


Figure 8-5 The intended user's product & emotion space.

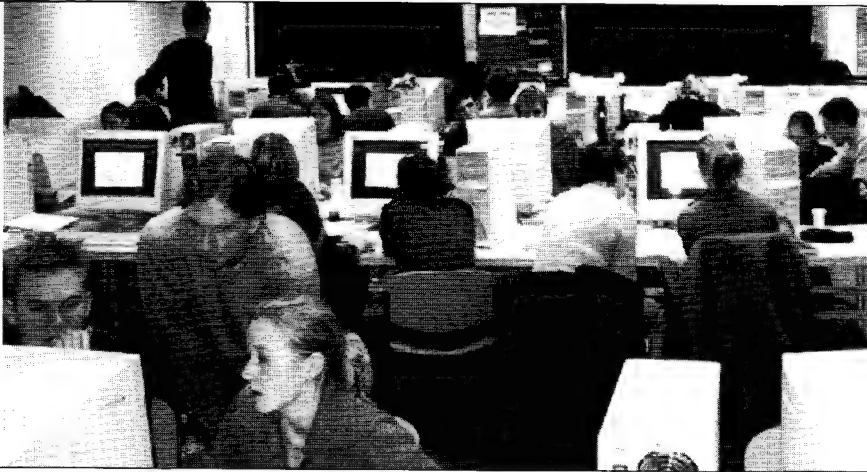


each alternative profile could be a fruitful starting-point for their design efforts.

This time, instead of using the four-step procedure that was used in the previous workshop, the participants were instructed to use the [p&e] navigator as a tool for enhancing their understanding of how to define concerns and appraisal (see Figure 8-6). They were given three hours to complete the task.



*Figure 8-6 [product & emotion] navigator session.*



At the end of the first part of the program each couple had created a pattern of eliciting conditions that included a concern profile of the targeted user, and the appraisals that elicit the intended emotions. The couples were invited to show their profiles to each other. Appraisals that had been formulated beforehand were then 'revealed' to the participants.

### **Part two**

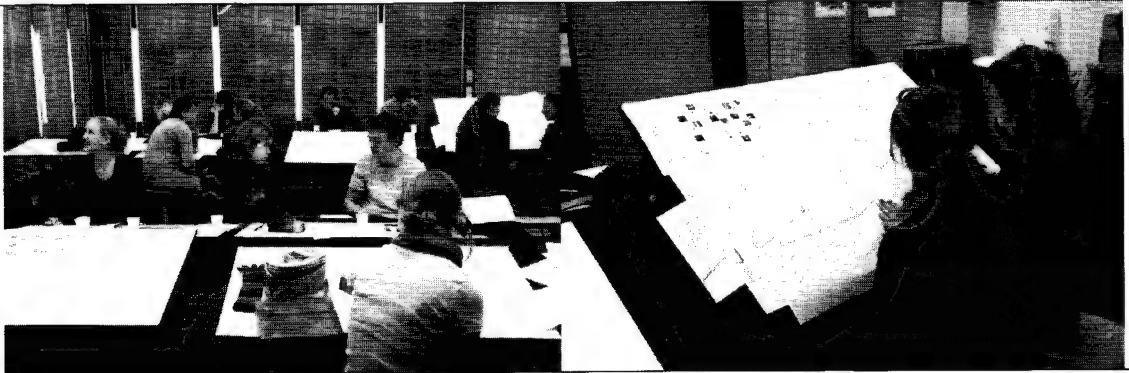
The second part of the program commenced with a short plenary explanation. The design process followed a two-step procedure, based partly on the design approach 'vision in product design' (Hekkert & van Dijk, 2001).<sup>4</sup>

- **Step a;** defining 'qualitative product characteristics.' The participants were asked to define a set of product characteristics that combine the appraisal mirrors and the users' concerns. Qualitative product characteristics are characteristics that describe the way a product is perceived, such as 'warm,' 'airy,' or 'ambitious'. This step makes it possible to define the product's character without focussing on a particular product.
- **Step b;** designing a product. The couples were asked to design products that fitted with the set of product characteristics. They were instructed to attempt to use all their insights of the intended users' concerns. They were free to design any kind of product, as long as they believed it would represent the set of qualitative product characteristics.

After the participants had finished drawing up their presentation sheets, they were invited to fill out an evaluation form that contained some questions regarding the



*Figure 8-7 Impression of the second workshop.*



value of the model of product emotions in general, and the navigator in particular. In the subsequent plenary session, the couples were invited to present their designs to each other.

## Results

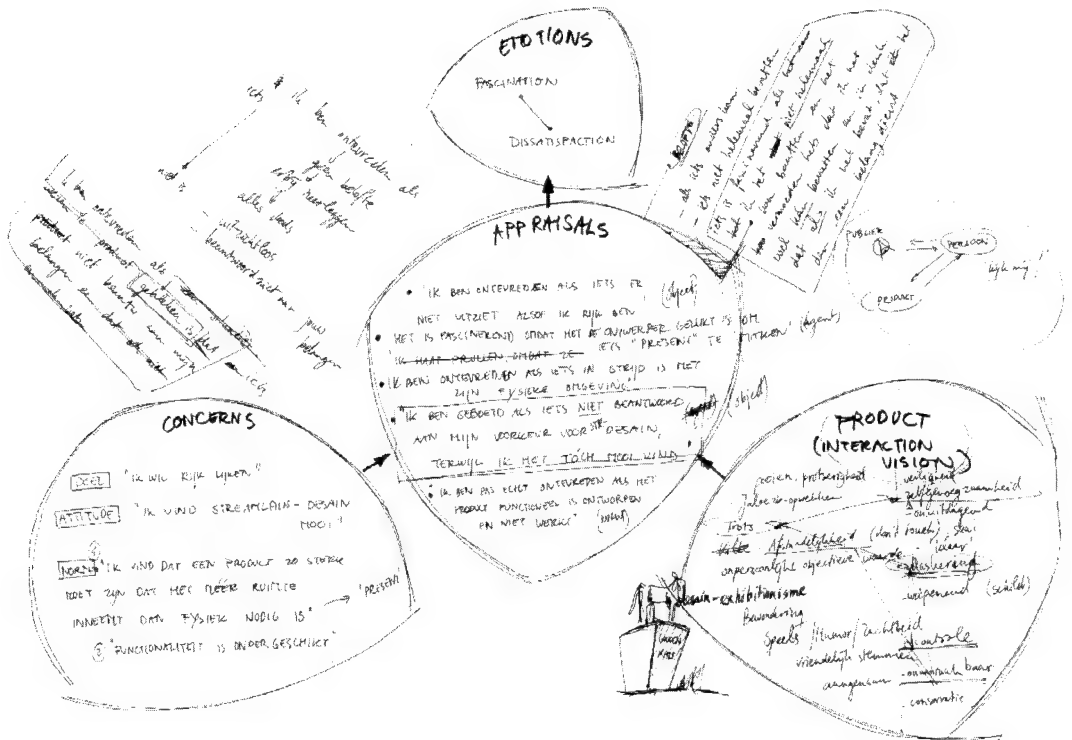
The first part of the program resulted in eight user profiles (one created by each couple) and the second part resulted in eight presentation sheets, each visualising a single product idea. Figure 8-7 shows an example of a user profile (including the appraisal mirrors and concerns) of one design couple, and Figure 8-9 shows two examples of designed products. Besides drawings of the products, for each product the figure shows the accompanying defined concern, selected emotions, and a short product description.

## Discussion

The workshop assignment was not simple. Participants were expected to select emotions, create appraisal mirrors and a concern profile, define qualitative product characteristics, choose a product and, finally, design a product that elicited the two chosen emotions. This task was much more complex than the task in the 'body cleanser' workshop (see Section 8.2). And yet, most participants felt confident that they had succeeded in designing a product that did elicit the predefined emotions. Moreover (as in the first workshop), in their presentation participants were able to convince the other participants and the supervisors that their designs had achieved this. Eight participants were confident that the targeted user would experience both predefined emotions. Four participants shared this confidence, but noted that probably one of the two emotions would be experienced more intensely than the other. Two participants reported that they were confident about one emotion but unsure about the second (they mentioned that this was the result of the limited amount of time reserved for the design phase).



Figure 8-8 Example of a created user profile.



### The [product & emotion] navigator

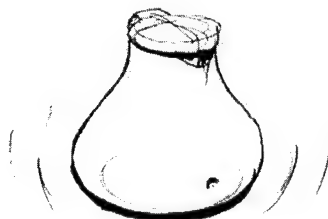
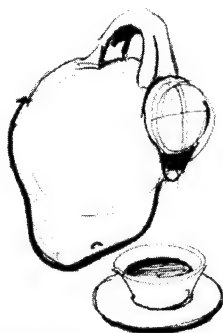
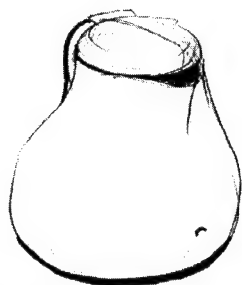
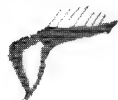
The central aim of the workshop was to assess the value of the [p&e] navigator. In general, the participants believed that the navigator helped them in understanding how products elicit emotions. Fourteen participants reported that the insights they had gained during the navigator session had helped them in some way during the afternoon program. Note that in spite of this, they found it difficult to pinpoint what the navigator's influence had been (e.g. "I'm sure that the navigator has influenced my design, although I cannot put into words in what way I was influenced).

Several participants reported that the navigator requires time and thought before it 'reveals' its value. One participant mentioned that "at first I didn't understand what the value of these highly individual examples was. However, after browsing for a while, I started to notice the resemblances and I started to get more of a grip on the generalities of product emotions." Six participants reported that if they had been able to spend more time, they would have learnt more. The participants were asked to report on the navigator's strengths and weaknesses in their evaluation forms.



Figure 8-9 The blob and the relaxation couch.

## THE BLOB



### "blob carafe"

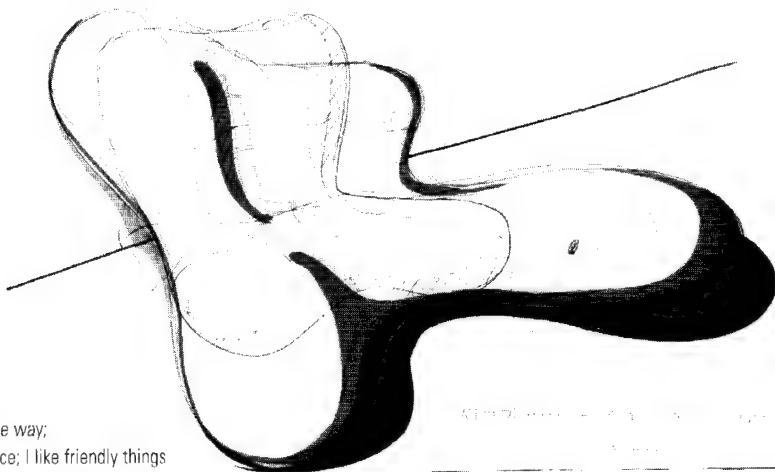
Emotions: fascination & disgust

Concerns: I want to acquire knowledge;

products should combine functionality with aesthetics; I dislike kitsch products

The blob is a carafe that is made of a flexible material. When it is filled it has a nice rounded shape. However, when it is tilted to pour the drink, the shape changes in an unpleasant 'blob' shape. In other words, the carafe is beautiful, as long as it is not used.

INTERACTIE - FORTUITIGHEID - MEEMINGEVOELINGEN



### "relaxation couch"

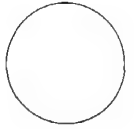
Emotions: fascination & indignation

Concerns: I want to be trendy in a safe way;

one should grant each other their space; I like friendly things

The relaxation couch is a big soft couch that does not have a predefined way of sitting in it.

You can sit in it in many positions. However, the material is a sticky kind of rubber. As a result, after sitting a few minutes, the couch pulls at your clothing, and therefore every position you try, is uncomfortable.



#### [product & emotion] navigator strengths

Eight participants explicitly mentioned that one of the most interesting features of the [p&e] navigator is that it allows one to browse on the basis of the different variables. This was found to be very valuable. Four participants reported that the navigator's major strength was that it helps the designer to understand general rules of how products elicit emotions. Another four participants mentioned that it helped them to distinguish emotions from needs, or emotions from each other (e.g. "it made me understand the differences between emotions and that all emotions are elicited in a different way"). Two participants felt that the navigator had been especially useful for structuring their own ideas about product emotions (e.g. "It enabled me to get a clearer image of my own ideas about emotions and to test these ideas"). Three participants felt that the main value of the navigator is that it enables the designer to dive deeper into the experiences of other people: "as some emotions came as a surprise to me, it widened my view of how people emotionally respond to products."

#### [product & emotion] navigator limitations

Two participants reported that a major limitation of the [p&e] navigator was that each case only included one emotion. These two participants wanted the navigator to include 'mixed emotions.' Three participants mentioned that it would have been more interesting if the emotional responses of more people towards the same product could have been included in the navigator. Four participants mentioned the danger of designers taking the cases in the navigator too literally (e.g. "there is a danger that designers take these examples too literally. This could lead to shallower instead of richer product designs"). Three participants mentioned that they had difficulties in drawing definite conclusions from the navigator. One participant mentioned that the insights of the navigator would be difficult to apply in mass-production because "different people have different concerns." Another participant missed the variable 'time' in the navigator ("as time is an important influencer of emotions").

## 8.5 Discussion

Can designers manipulate the emotional impact of their designs? This was the question that served as the starting-point for part C of this thesis. The two workshops reported in Chapter 8 indicate that the model of product emotions can indeed support designers who want to design products that elicit predefined emotions. Moreover, the [product & emotion] navigator was found to be an adequate tool for designers to use to familiarise themselves with the model and the emotion-specific patterns of eliciting conditions.



An important strength of the [p&e] navigator is that it enables designers to *discuss* emotions and the conditions that give rise to these emotions. In the workshop it was found that designers who had 'played' with the navigator were able to use the model's key variables to formulate design aims in terms of emotional responses. They were able to explore the emotional aspects of their design in remarkable detail (see, for example, the user profile in Figure 8.8). The navigator provided designers with a language of emotions that enabled them to work on the design task as a team. Moreover, this language was also found to be useful for supporting design decisions. In the presentations, using the model's key variables, the workshop participants were able to express their aims and to convince others of the emotional impact of their product ideas.

To summarise, on the basis of the workshop experiences, it was concluded that the [p&e] navigator's main strength is that it supports designers in manipulating the emotional impact of their designs, while not conflicting with the designers' personal visions on, and ideas about, product emotions. The navigator allows the designer to 'blend' the distinctions of the model of product emotions with his or her own ideas about how products elicit emotions. In this way, the tool expands the designer's design possibilities, rather than confining these possibilities within prescriptive 'design rules.'

## Notes

- [1] Note that answering these questions was not the only aim that shaped the workshop's design. The participants were not mere 'subjects' but professional designers who volunteered to invest a day of their time in this workshop. *Therefore, first and foremost, the workshop was designed to provide them with an inspiring, informative, and enjoyable experience.*
- [2] The Design and Emotion Society was established by a group of designers and researchers who believe that the emotional experience could, and should, be a starting point in product design. The Society's major aim is to be a platform for researchers, designers, and industry to exchange ideas on activities, developments, and insights in the field of design and emotion. More information can be found on [www.designandemotion.org](http://www.designandemotion.org).
- [3] A similar product & emotion space was reported in Chapter 5 (see Figure 5-2). That space was the outcome of a *correspondence analysis*. *The space applied in the workshop was not based on research but was created with the use of products that were drawn from the results of Study 9 (see Section 7.2 to 7.7 in Chapter 7).*
- [4] All participants were familiar with this design approach because they had been enrolled for the workshop from a course in which this approach is taught.

# General discussion



What is the relationship between product appearance and emotions? This simple question initiated four years of 'designing emotion' research. Along the way, two tools were developed and applied in studies and workshops. We found that although emotions are personal, the patterns of eliciting conditions that underlie them are universal. In addition, we saw that product emotions can be quantified and visualised with the use of 'product & emotion spaces,' and 'emotion profiles.' And, we saw that people can be clustered in multicultural 'affect groups.' Note that, although this is not always explicitly mentioned, designers were involved in each stage of the research project. Insights drawn from communicating and working with these designers are discussed in the current section. Because the research findings and both tools have been discussed in the discussion sections of Part A, B, and C of this thesis, the current discussion is restricted to implications and application possibilities of the research results.

## **Tool applications**

The aim of this research was to develop tools and knowledge that would support designers in manipulating the emotional impact of their designs. The tools that were developed can support designers (and companies) in various ways. Four application possibilities are for (1) internal communication, (2) defining emotional strategies, (3) finding emotional target groups, and (4) guarding emotional consistency.

## **Communicating emotions**

Last year, PrEmo and its application possibilities were presented to some of the designers and the design management of Mitsubishi Europe. After the presentation, in an informal talk, one of the designers told me that he was happy to see that finally he had a tool that he could use to convince the people in marketing of his ideas. Initially this remark confused me because, in my eyes, PrEmo was not intended to endorse the ideas that designers already have, but rather to stimulate them to create *new* ideas. After some discussion, however, I realised that the designer's remark illustrated what may be one of the main values of PrEmo.

Designers generally operate in a design team, which in turn is imbedded in a corporal structure that includes departments such as engineering, new product development, and marketing. A designer who has a particular idea or design vision must 'sell' that idea or vision to all other parties involved in product development. In this process of communication, the design's emotional aspects are especially difficult to defend, simply because these are often based on intuition. What the designer recognized in the 'emotion profiles' and the 'product & emotion space' was a possible way to communicate, argue, and defend his ideas about the emotional aspects of his designs. In that light, an important advantage of PrEmo is that it can 'objectify' emotional responses and make these responses tangible.



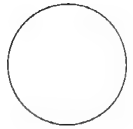
### Emotional design strategy

In Study 8, emotions elicited by six car models from Japan and The Netherlands were measured. After the results had been analysed, we flew to Japan to present these results at the Mitsubishi Tama Design centre. The 'product & emotion space' that is shown in Figure 5-2 (in Chapter 5) was one of the presented visuals. To my surprise, in reaction to this space, the design managers of Mitsubishi displayed a particular interest in the emotions elicited by the Fiat Multipla. Note that the space clearly indicates that this car model elicits mainly unpleasant emotions, such as disgust and indignation. The design managers explained that this model had caught their eye for two reasons. First, they knew from experience that if, on average, a car model elicits strong unpleasant emotions, there will always be a small group of consumers that is particularly keen on this model. In addition, their experiences had also taught them that such strong unpleasant emotions might very well turn into positive ones, once the model is launched on the market.

These ideas about the meaning and implications of the relationships indicated in a 'product & emotion space' illustrate the second application possibility of PrEmo, i.e. it can be used to establish an 'emotional strategy.' Studies conducted with PrEmo, and the resulting product & emotion spaces, offer an overview of the emotional play-field in which a company operates. In the 'designing emotion' workshop (reported in Section 8.3) it was found that it is possible to use such a space as the starting-point for a design project. Hence, the space can be used to set an 'emotional target' for new product designs. The 'Fiat Multipla' anecdote, described above, illustrates that this target does not necessarily have to include only pleasant emotions. All sorts of product & emotion spaces can be created to serve as a starting point for the definition of an emotional strategy. One can, for example, investigate and visualise how the emotions of a particular product compare to those of competing brands; or one can investigate and visualise the emotional responses towards different products sold under one brand.

### Emotional target groups

Emotions are personal. Different people may experience different emotions towards a given product. Although this idea was supported by the results of Study 8, in this study it was also found possible to cluster respondents in 'affect-groups' on the basis of their emotional responses. People within these affect-groups experienced similar responses towards the car models. In addition, it was found that affect-group membership was *not* related to the variables traditionally used to define target-groups, i.e. demographic variables such as gender and age. The respondents within affect-groups were men and women, young and old. Apparently, emotions are not determined by age and gender. We saw in Chapter 6 and 7 that emotions are determined by underlying concerns. It may be that the persons



within an affect group may be described in terms of their concerns.

A second interesting finding in Study 8 was that (as opposed to gender and age) culture has an effect on the emotional responses. Some Japanese people felt different responses to those of the Dutch. This may indicate cultural differences in underlying concerns. Although some concerns are universal (e.g. the concern of safety and the concern of belonging), others are known to differ between cultures (e.g. attitudes such as some tastes). It would be interesting to investigate the possibility of describing affect groups in terms of underlying concerns. An investigation could be done of which cross-cultural target-groups, and which within-culture target-groups, can be defined for a particular product category. On the basis of the underlying concern patterns, one could subsequently aim to create designs that fit the emotions of each of these target groups.

### **Emotional consistency**

In February of this year the New York Times published an interview with Gerald Zaltman, a marketing professor at the Harvard Business School, about a study that his research group conducted for Coca-Cola in Europe (Eakin, 2002). This study investigated the feelings people have about the brand Coca-Cola. The main conclusion (as reported in the interview) was that this brand evokes not just feelings of invigoration and sociability – something its maker had long known and exploited in its ads – but also feelings of calm, solitude and relaxation. In the interview, Zaltman stated that “the big insight we had is that Coke is really two drinks in one. They’d really been marketing half a Coke.”

The focus of the current study was on emotions elicited by product appearance. Naturally, the emotional impact of a product is not only determined by its appearance. The emotion is elicited by meanings derived from the in-store-display, brand, previous experiences, etcetera. It is the combination of all these emotional stimuli that determines what emotions a person experiences towards the product. Many companies invest a lot of energy in creating and supporting a brand image with the use of advertisements. An important question is if the emotions elicited by the product’s appearance connect to the emotions elicited by the brand. PrEmo studies can be used to investigate the ‘emotional consistency’ of all aspects of communication. Examples of questions that can be addressed in a PrEmo study are: Are the emotions elicited by the product in line with the emotional meaning of the brand? Are the emotions elicited by the indoor-display and the product brochure in line with the emotions elicited by the product’s appearance? Are the emotions elicited by a particular model in line with those elicited by the other products in the product line?

### **Emotion and behaviour**

Most companies are not interested in emotions as such, but rather in the influence of



emotions on consumer behaviour or, to be specific, the influence on behaviour. The influence of emotions on purchase decisions, has not been the object of the current study. Nevertheless, there is no doubt that emotions influence our purchase behaviour. Remember the discussion in Chapter 1 of the evolutionary perspective of emotions. In this perspective, the function of emotions is to signal events that are important to us and incite behavioural tendencies to act to satisfy our concerns. In other words, behaviour (or behavioural tendencies) is widely accepted to be a central aspect of the emotion. Famous theories of emotion, such as those developed by Frijda (1986) and Lazarus (1991) give the behaviour a central place in the definition of what emotions are. Examples of behavioural tendencies that accompany product emotions are the tendency to touch, reject, buy, use, discard, break, etcetera.

### **Buy me now!**

It is not hard to imagine that the behavioural tendency that most companies are interested in is the 'tendency to buy a product.' Naturally, we are not driven by our emotional behavioural tendencies alone. Frijda (1986) argued that we are often quite capable of overruling these tendencies. We may feel attracted to a sports car, but that does not mean we will actually buy one. The decision to buy a product involves many considerations besides the emotions.

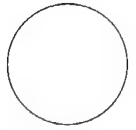
Nevertheless, in some cases it seems that our emotions 'take over' and are the decisive factor in a purchase decision. Does a 'buy me now' emotion exist? If there is such a thing, it is most likely to be the emotion 'desire.' According to Frijda (1986, p. 84) the essence of desire is the "readiness to approach or bring about situations of satisfaction" which, in the case of products, may very well involve purchase. In Chapter 7 we saw that, on the basis of eliciting conditions, three types of desire can be distinguished, i.e. 'desire of consequence,' 'desire of identity,' and 'aesthetic desire.' Although speculative, it may be possible that the 'buy me now' emotion is a simultaneous experience of the three types of desire. In that case, the product resonates with what we want to be or become, want to experience or own, and want to achieve or obtain.

### **Usage emotions**

The focus of the current research was on emotions elicited by product appearance. We all know from experience that products can also sometimes elicit strong emotions during use. For designers, these usage (and ownership) emotions are no less important than the emotions elicited by appearance, because these emotions also influence our emotional well-being, and are important for product differentiating.

The set of 14 emotions measured by PrEmo is specifically those that are relevant for product appearance. During usage, the array of often-experienced emotions may be broader than what is captured with these 14 emotions. In Chapter 7, we saw that





products can elicit emotions as an agent, as an object, or as an event. In the case of product appearance, the latter (as an event) occurred only in the form of 'anticipated event' or 'symbolised past event.' Although the appearance of the product can refer to or symbolise events, it is not an event as such. Product usage, however, *is* an event, and therefore more event-type emotions will probably occur (e.g. joy and regret, see Ortony et al. 1988). In Chapter 2, it was found that some of the basic emotions are not often elicited by product design (i.e. shame, guilt or fear). These emotions might be often elicited when a product is used. For example, Anne may fear that her data is lost when her computer crashes, and she may be ashamed to drive an ugly car. Thomas may feel guilty because he used number recognition on his telephone to avoid answering his mother's call. It would be interesting to investigate how the model of product emotions and the set of product emotions included in the two tools could be broadened (or altered) to cover emotions elicited by product usage and ownership.

### **Stay with me**

Apart from the fact that the existence of a 'buy me now' emotion is purely speculative, should companies strive to elicit this emotion? In the long run, it may be more fruitful to establish a long-term 'emotional relationship' with the customer than to aim to manipulate the customer into buying something.

The behaviour of buying a product is not the only behaviour influenced by emotions. Emotional responses can also motivate one to discard a product before it is worn out. Many of the products (in our Western society) are discarded long before they reach that point. Emotions are often involved in the decision to discard products that still function. Note that emotional responses can also motivate people *not* to discard a product. Emotional attachment to products can motivate us to keep products sometimes even when they are no longer functioning. An interesting initiative in the study of the relationship between product design and emotional attachment was reported by van Hinte (1997). In this book, design studies are reported that explore the influence of the designer on post-purchase emotional attachment.

### **Future research**

#### **Product emotions**

In the introduction of this thesis, it was stressed that products can elicit more than one emotion simultaneously. One can, for example, feel both dissatisfied and fascinated by a given product. Given this characteristic of 'product emotions,' it was decided to follow a typology approach and to study distinct emotions (as opposed to emotional states in terms of pleasantness and arousal). In chapter 2, a set of product relevant emotions was developed, and the research was subsequently focussed on



these emotions. The strength of this approach is that the focus on distinct emotions can help to disentangle the layers of emotions and emotional meanings in terms of the appraised social, aesthetic, functional (etcetera) relevance of the product.

A limitation may be that emotions are polarized, and that simple feelings of arousal and pleasantness, which are also relevant emotional responses towards artefacts, have been left unstudied. Cupchik (1995) stressed that, for aesthetic processing, both approaches are relevant (i.e. reflective and reactive models of emotion). Given the current approach, emotions that result from reactive processing have been paid little attention and are not measured by PrEmo. For future research, it is recommended that the place of reactive emotions in the model of product emotions should be investigated.

### Tool box

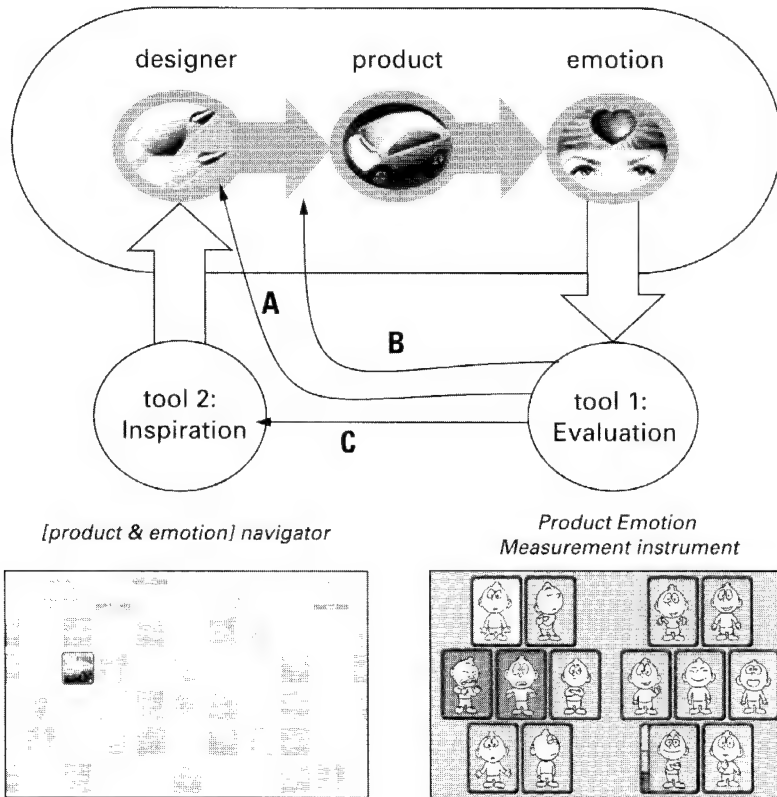
Figure 1 shows the two tools that were developed in this research. Although the value and applicability of both tools has been demonstrated (see Chapters 5 and 8), they both require further refinement. The number of cases included in the [product & emotion] navigator will be increased from approximately 400 cases to around 1000 to ensure that for all possible playfield definitions sufficient cases are included. Some of the animations used in PrEmo require further development because in their current shape they are not unambiguously clear in all cultures.

PrEmo was developed to measure emotions elicited by the produced product design. In future research the value of the PrEmo results at the start of a design project could be investigated (i.e. arrow A). In the second workshop (see Section 8.4 in Chapter 8) a PrEmo 'product & emotion space' was used as the input for designers. In addition, PrEmo can be used during the design process to test preliminary product ideas or concepts (arrow B). Finally, the PrEmo results may also serve as input of the [p&e] navigator (arrow C).

### Time

In the introduction of this thesis, one of the mentioned characteristics of product emotions is that they are temporal. Our emotional responses towards a given product change, diminish, or evolve over time. This does not only apply to individuals but also probably to average emotional responses within cultures or societies. It would be interesting, for example, to use PrEmo in a longitudinal study of a set of car models. The emotional development from the point of market introduction to the point of maturity (or beyond) could be investigated. The example of the Fiat Multipla was used to illustrate that aiming for the positive emotions may not always be the smartest strategy. Mitsubishi was interested in that particular model specifically because of the unpleasant emotional responses it elicited. In longitudinal studies, the effects of a change of strategy in advertising on the emotions of products could also be investigated.

Figure 1 Applying PrEmo results.



### Concerns

In Chapter 8 it was hypothesised that people within 'affect groups' may share their concerns regarding car design. A logical step in this research would be to investigate the possibility of measuring concerns. If it were possible to measure concerns, the relationship between concerns and emotions measured with PrEmo could be investigated. This knowledge would be of use in the development of the 'emotional target groups' mentioned above.

Frijda (1986) suggested that there is a distinction between concerns that are terminal and those that are instrumental. Some concerns are terminal (or basic) in the sense that they are not derived from higher-level concerns. Terminal concerns are abstract and universal, for example 'entertainment' and 'individuality.' Many taxonomies of such terminal concerns are reported in the research literature. Schwartz



(1992), for example, developed an often-cited typology that includes 10 distinct value types (i.e. power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, and security).

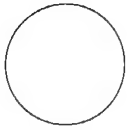
Instrumental concerns are derived from terminal concerns and are therefore less abstract and more immediate. They can be seen as serving the higher order terminal concerns. Examples of instrumental concerns are 'communication' and honesty (both derived from the terminal concern of belonging). The proposition that some concerns are more basic than others is widely accepted and can be found in other fields of research, such as consumer research (see e.g. the means-end model developed by Gutman, 1991). A structure that is often applied in consumer research was developed by Rokeach (1968). He developed a survey (Rokeach Value Scale; RVS) that measures 18 terminal and 18 instrumental concerns. Although any concern taxonomy will necessarily be limited by the fact that a person's concerns are context-specific and highly personal, a standardized classification scheme can facilitate the process of making comparisons across individuals and groups, such as the care style groups defined in Chapter 5. The next step in this research is to investigate the relationship between emotional responses and concerns as measured with scales such as the RVS.

### **Designing emotions**

In the introduction of this thesis, a quote of Cacioppo et al. (2001) was used to illustrate the strong influence of emotions on our well-being. Note that this quote was not used to plead that it is the designers' task to design products that elicit *only* pleasant emotions. First, whatever the 'task' of a designer may be is up to his or herself. Each designer should decide on (and take responsibility for) what he or she aims to accomplish with a product, and whether or not this includes some emotional intention. I do not consider it the task of design researchers to define design rules or design ethics of what design should be. Second (and more important), it would be naïve to assume that to serve the well-being of humans one should design products that elicit *only* pleasant emotions. It may be much more interesting to design products that elicit 'paradoxical emotions,' that is positive and negative emotions simultaneously.

### **Paradoxical emotions**

In 1995 British artist Damien Hirst won the prestigious Turner prize with his work 'mother and child divided,' a cross-cut of a pregnant cow moulded in perspex. He created similar works displaying other animals such as sharks. Both the concept and the design of these works are simple and straightforward. What makes them especially interesting is that, in contrast to the concept's straightforwardness, the observers' emotional responses are layered and complex. In fact, these works of art



may be considered the perfect example of elicitors of 'mixed emotions.' Emotions may be stirred by the peaceful serenity of floating animals, the beauty and perfection of these creations of nature, the frightening and revolting look inside an animal, and also by the guts it took for Hirst to create the works, the scandal that they are considered art, and so on.

Naturally, in that sense, the work of Hirst is not unique. In fact, much (if not most) art, from Duchamp's toilet to Jef Koons' 'art-porn,' elicits mixed emotions. Frijda and Schram (1995) stated that art often elicits paradoxical emotions, and that it is precisely these paradoxical emotions that we seek and enjoy. In the words of Frijda (p. 2) "we enjoy watching tragic miseries, and we pay fair amounts of money to suffer threat and suspense." It may be interesting for designers to investigate the possibilities of designing 'paradoxical' emotions. A designer could, for example, design a product that awakens what Frijda (1986) calls latent concerns, or a product that confronts its user with his or her sometimes contradictory concerns (see also Dune & Raby, 2001). Eventually, these efforts may result in products that are unique, innovative, rich, and interesting.



# Summary Designing Emotions



Emotions enrich virtually all of our waking moments with either a pleasant or an unpleasant quality. Given the fact that a substantial part of these day-to-day emotions is elicited by cultural products, such as art, clothing, and consumer products, designers may find it important to include emotions in the intentions of their design efforts. In addition, emotional responses can induce customers to pick a particular model out of the row, and might therefore have a considerable influence on our purchase decisions. As a consequence, more and more producers nowadays challenge designers to manipulate the emotional impact of their designs. In design practice however, emotions elicited by products are often considered to be intangible and therefore impossible to manipulate. For that reason, this thesis is concerned with the relationship between product design and evoked emotions. The research focus is on emotions elicited specifically by product *appearance*. The author's major claim is that because these emotions are not as intangible as they seem, designers *can* influence the emotional impact of their designs.

The thesis is structured in three parts, of which each focuses on a particular aspect of product emotions. In Part A, emotions and product emotions are described and defined. Next, Part B reports the development, validation, and application of an instrument to measure product emotions. Part C reports the development and application of an instrument that assists designers in 'designing emotions.' In the general discussion, it is discussed how the tools can be integrated and applied in design practice.

## **Part A: defining product emotions**

Chapter 1 examines current perspectives in psychology, defines the phenomenon 'emotion,' and discusses its nature. Emotions are distinguished from other types of affective states, such as moods and sentiments, and various approaches often employed to differentiate between emotions are discussed. The main conclusion is that product emotions are not a special type of emotions, but are as 'real' as, and have the same qualities as the emotions we experience in our social interaction. A quality shared by all emotions is that they always imply and involve a relation between the person who experiences them and a particular object. That object is not necessarily the product itself, but can also be some associated object, event, or person. One can, for instance, be *fascinated* by an innovative new bicycle concept (the object is the bicycle itself), or be *inspired* by the sight of a backpack because it reminds them of an exciting hiking expedition (the object is the associated memory).

The second chapter focuses on the question which emotions are (and which are not) generally experienced in response to product appearance. Emotions that are experienced often (e.g. *satisfaction*) are considered to be more relevant than those that are experienced only rarely (e.g. *rage*). A series of three studies is reported, which was performed to assemble a set of 41 emotions that represents a manageable



overview of 'product relevant emotions' (see Figure 2-7). Typical to the set is that it includes many 'evolved' emotions (e.g. *boredom*, *inspiration*, and *amusement*), that is, emotions that require more cognitive processing than basic 'survival' emotions such as *fear* and *anger*.

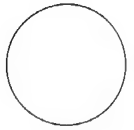
### Part B: measuring product emotions

The second part of the thesis focuses on the question of how to measure product emotions. Chapter 3 reviews existing instruments and reports the development of the Product Emotion measurement instrument (PrEmo). PrEmo is a non-verbal self-report instrument that measures 14 (product relevant) emotions. Instead of relying on the use of words, respondents can report their emotions with the use of a set of expressive cartoon animations. Each animation portrays an emotion by means of dynamic facial, bodily, and vocal expressions (see Figure 3-11). The unique strength of PrEmo is that it combines two qualities: it measures *distinct* emotions and it can be used *cross-culturally*. In addition, it can be used to measure mixed emotions, that is, more than one emotion experienced simultaneously, and the operation requires neither extensive equipment nor technical expertise.

Chapter 4 reports the validation of both the animations and the instrument. Given the requirement of cross-cultural application possibilities, the PrEmo animations were validated in various countries (i.e. The Netherlands, Japan, Finland, and the USA). All animations were found to be reliable. Although valid in The Netherlands, the USA and Finland, two animations were found to be invalid in Japan (i.e. *desire* and *disappointment*). An explorative study with Japanese actors is reported that was used to determine how these animations should be adjusted to ensure validity in Japan. Next, Study 7 was performed to assess the validity of the instrument. In this study, emotions elicited by six chairs were measured both with PrEmo and with verbal rating scales. The results obtained with PrEmo showed a remarkable high agreement with those obtained by way of verbal rating scales, indicating convergent validity. In addition, respondents agreed that the set of 14 animations was sufficient to adequately report their emotions. Moreover, the animations were found to be more intuitive and enjoyable to use than the verbal scales. Based on these findings, it was concluded that PrEmo adequately enables the researcher to study the relationship between product design and emotional responses.

Chapter 5 reports Study 8, which was performed to explore PrEmo's cross-cultural application possibilities. Emotions elicited by six car models were measured both in Japan and in The Netherlands, and visualised in a 'product & emotion space' (see Figure 5-2). The study demonstrated that PrEmo enables the researcher to differentiate product designs on the basis of the consumers' emotional responses. With the results, for each car model an 'emotion profile' was drawn up. These profiles showed significant between-car differences and indicated that the cars elicit 'mixed





emotions,' which in some cases even included both pleasant *and* unpleasant emotions simultaneously.

Although it was expected to find relationships between emotions, age and gender, it was found that neither age nor gender could be used to explain variance in the respondents' emotional responses. Culture on the other hand, was found to produce a significant effect on these responses. On the basis of the measured responses, respondents were clustered in three 'affect-groups.' Particularly eye-catching was that one affect-group was composed only of Japanese respondents. Apparently, a group of Japanese people exists that does not have a Dutch equivalent with respect to experienced emotions.

### **Part C: designing product emotions**

People differ with respect to their emotional responses towards a given product. Nevertheless, in spite of these interpersonal differences, the process of emotions, that is, the way in which emotions are elicited, is universal. Chapter 6 reports a general model of product emotions that sets forth three main parameters that determine if a product elicits an emotion, and if so, what emotion is elicited (see Figure 6-2).

The cognitive, functionalist position on emotion posits that emotions serve an adaptive function. In this view, emotions are considered the mechanisms that signal when events are favourable or harmful to one's concerns. This implies that every emotion hides a concern, a more or less stable preference for certain states of the world. A product will only elicit an emotion if it either matches or mismatches a concern. Why do I feel attracted to an umbrella? Because I have a concern for staying dry. And why am I frustrated when my computer repeatedly crashes? Because I have a concern for efficiency. The process of signalling the personal relevancy of an event is commonly conceptualised as 'a process of appraisal.' An appraisal is a non-intellectual automatic judgement of the meaning of a situation, in which our concerns serve as points of reference.

In chapter 6, the three proposed parameters are explored and discussed. It is examined what concern and appraisal types are relevant for product experience, and how products can act as emotional stimuli. These parameters combine to emotion-specific patterns of eliciting conditions. Because such patterns can support designers in their exploration of the relationship between product design and emotional responses, they are explored in depth in Chapter 7. This exploration was based on Study 9, in which respondents made photos of products in their daily surroundings that elicit distinct emotions. This study resulted in a database of hundreds of anecdotal cases, including both pictures and written rationales that explain the cause of the experienced emotions. It was found that on the one hand a similar product can elicit many different emotions, but on the other hand, the underlying process can be explained with the parameters and their relation as outlined in Chapter 6.



It was hypothesised that a designer can use these parameters to 'get a grip' on the emotional impact of his or her designs. To that end, the [product & emotion] navigator was developed (see Figure 8-3). This educational tool is a virtual product and emotion space that visualises the cases that were obtained in Study 9. As the [p&e] navigator is intended to be a tool of inspiration, the interface was designed to establish interaction that is conceived as challenging, persuasive, and elegant. The interaction is open-ended; it does not have a start, an ending, or a predefined search-path. One can, for example, use a particular emotion, a particular product, or any of the parameters as a starting point of a [p&e] navigator session.

The design community was actively involved in the development and application of the [p&e] navigator through the organisation of two design workshops. The chapter reports on a workshop in which designers used the parameters to design 'body cleansers' that elicit predefined emotions. Insights drawn from this workshop were used to shape the [p&e] navigator. Next, the tool was applied in a second workshop in which participants designed products that elicit predefined sets of mixed emotions. Both the implications of the model for design practice and the [p&e] navigator's strengths and weaknesses are discussed.

#### General discussion

In the general discussion, the application possibilities of the results are discussed. The two tools can, for instance, be used to develop emotional design strategies, to define emotional target groups, and to investigate emotional consistency of a company's marketing efforts. In addition, the relationship between product emotions and behaviour (in either purchase, usage, or ownership) is briefly discussed. Recommendations for future research and tool development are reported.

Finally, the implications of the research for design practice are discussed. It is not proposed that to serve humans' well-being, designers should create products that elicit only pleasant emotions. Instead, it may be interesting to design products that elicit 'paradoxical emotions,' that is, positive and negative emotions simultaneously. In experiencing art, it are precisely these paradoxical emotions that we often seek. It may be interesting for designers to investigate the possibilities of designing paradoxical emotions because this may result in products that are unique, innovative, rich, and more challenging or appealing than those that only elicit pleasant emotions.

# Samenvatting Emoties Ontwerpen



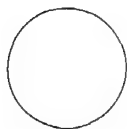
Emoties kleuren alle ervaringen met een aangename of onaangename beleving. Aangezien een substantieel deel van onze dagelijkse emoties wordt opgewekt door culturele producten zoals kunst, kleding en gebruiksproducten, is het voor een ontwerper belangrijk emoties een plek te geven in zijn of haar ontwerpintenties. Bovendien kunnen emotionele reacties ons verleiden een bepaald model uit het schap te pakken en zodoende aanschafbeslissingen aanzienlijk beïnvloeden. Het gevolg hiervan is dat vandaag de dag steeds meer producenten ontwerpers aansporen de emotionele impact van hun ontwerpen te manipuleren. In de ontwerppraktijk worden emoties opgewekt door producten echter vaak beschouwd als ongrijpbaar en daarom als onmogelijk te manipuleren. Dit proefschrift is daarom gericht op het uiteenrafelen van de relaties tussen product ontwerp en emotie. De focus van het onderzoek is gericht op emoties opgewekt door het *aanschouwen* van producten. De auteur stelt dat ontwerpers de emotionele impact van hun ontwerp weldegelijk kunnen beïnvloeden omdat emoties minder ongrijpbaar zijn dan ze op het eerste gezicht lijken.

Het proefschrift bestaat uit drie delen. Ieder deel belicht een aspect van 'productemoties.' In deel A worden emoties en productemoties beschreven en gedefinieerd. Vervolgens rapporteert deel B de ontwikkeling, validatie en toepassing van een instrument voor het meten van productemoties. Deel C beschrijft de ontwikkeling en toepassing van een hulpmiddel ter ondersteuning van het 'ontwerpen van productemoties.' Tot slot wordt in de algemene discussie een aanzet gegeven tot het integreren en toepassen van de ontwikkelde hulpmiddelen in de ontwerppraktijk.

## **Deel A: het definiëren van product emoties**

Hoofdstuk 1 neemt de huidige ontwikkelingen in de psychologie onder de loep en definieert op basis hiervan het fenomeen 'emotie.' De verschillen tussen emoties en andere gevoelstoestanden (zoals stemmingen en sentimenten), en tussen emoties onderling worden behandeld. Een belangrijke conclusie is dat emoties opgewekt door producten 'echte' emoties zijn en dezelfde eigenschappen hebben als de emoties in de relationele sfeer. *Alle* emoties impliceren een relatie tussen de persoon die ze ervaart en een gegeven object. Met betrekking tot producten hoeft dit object niet per se het product zelf te zijn, maar kan het ook een object, gebeurtenis, of persoon zijn die met het product wordt geassocieerd. Iemand kan bijvoorbeeld *gefascineerd* zijn door een innovatieve fiets (het object is de fiets zelf), of *geïnspireerd* raken bij het aanschouwen van een rugzak omdat deze hem of haar herinnert aan een prikkelende klimexpeditie (het object is de geassocieerde herinnering).

Het tweede hoofdstuk behandelt de vraag welke emoties relevant zijn bij het aanschouwen van producten. Voor het onderzoek zijn emoties die vaak worden opgewekt (zoals *tevredenheid*) relevanter dan emoties die slechts sporadisch worden opgewekt (zoals *woede*). In een serie van drie experimenten is een set van 41



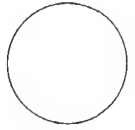
emoties samengesteld die een hanteerbaar overzicht biedt van 'product relevante emoties' (zie figuur 2-7). Kenmerkend is dat deze set veel 'ontwikkelde' emoties bevat (zoals *verveling*, *inspiratie*, en *amusement*), dat wil zeggen emoties die meer cognitie vereisen dan basale emoties zoals *angst* en *woede*.

### Deel B: het meten van product emoties

Het tweede deel van het proefschrift behandelt de vraag hoe productemoties kunnen worden gemeten. Hoofdstuk 3 bespreekt bestaande instrumenten en rapporteert de ontwikkeling van de productemotie meter (*Product Emotion Measurement instrument* – PrEmo; zie figuur 3-11). PrEmo is een non-verbaal instrument waarmee 14 product relevante emoties kunnen worden gemeten. In plaats van met woorden, rapporteren respondenten hun emoties met behulp van een set animaties. Een getekend karakter portretteert in iedere animatie een specifieke emotie door middel van zijn expressie in gezicht, stemgeluid, en lichaam. Uniek aan PrEmo is dat het instrument twee kwaliteiten combineert: het meet onderscheidbare emoties en kan crosscultureel worden toegepast. Bovendien kan het gebruikt worden om samengestelde emoties (combinaties van meerdere emoties tegelijk) te meten. Verder vereist de toepassing geen uitgebreide uitrusting of technische expertise.

Hoofdstuk 4 beschrijft de validatie van de animaties en het meetinstrument. Omdat het instrument crosscultureel zal worden toegepast, zijn de animaties in een aantal landen gevalideerd (Nederland, Japan, Finland en de VS). Alle animaties zijn betrouwbaar en valide bevonden in Nederland, de VS en in Finland. Echter, twee animaties (*verlangen* en *teleurstelling*) bleken niet valide te zijn in Japan. Met behulp van een exploratie met Japanse acteurs is bepaald hoe de animaties moeten worden aangepast om de validiteit in Japan te waarborgen. Om de validiteit van het instrument te bepalen werd vervolgens experiment 7 uitgevoerd. In dit experiment zijn emoties opgewekt door zes stoelen gemeten zowel met PrEmo als met verbale schalen. De resultaten verkregen met PrEmo bleken opmerkelijk consistent met deze verkregen met de verbale schalen. Daarnaast waren de respondenten het met elkaar eens dat emoties adequaat en volledig kunnen worden gerapporteerd met de 14 animaties. Bovendien werden de animaties intuïtiever en plezieriger bevonden dan de verbale schalen. Gebaseerd op deze bevindingen is geconcludeerd dat PrEmo een geschikt instrument is voor het onderzoeken van de relatie tussen product vormgeving en emotionele reacties.

Hoofdstuk 5 beschrijft experiment 8 waarmee de crossculturele toepassingsmogelijkheden van PrEmo zijn geëxploreerd. Emoties opgewekt door zes automodellen zijn gemeten zowel in Japan als in Nederland, en vervolgens gevisualiseerd in een 'product en emotie ruimte' (zie figuur 5-2). Met het experiment werd aangetoond dat PrEmo de onderzoeker in staat stelt producten te onderscheiden op basis van de emotionele reacties van consumenten. Met behulp van de resultaten is voor ieder



automodel een 'emotieprofiel' opgetekend. Deze profielen laten significante verschillen tussen de auto's onderling zien, en geven aan dat de auto's samengestelde emoties opwekken (soms zelfs aangename en onaangename emoties tegelijkertijd).

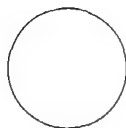
In tegenstelling tot de verwachte relatie tussen emotie, sekse en leeftijd, bleken leeftijd noch sekse enige variantie in emotionele reacties te verklaren. Cultuur daarentegen, bleek wel een significant effect te hebben op de emotionele reacties. Op basis van de gemeten emoties werden respondenten geclusterd in drie 'affectgroepen.' Opvallend was dat één affectgroep bestond uit alleen Japanse respondenten. Blijkbaar bestaat er een groep Japanners die (wat betreft emotionele reacties op de zes automodellen) geen Nederlands equivalent heeft.

### **Deel C: het ontwerpen van product emoties**

Verschillende mensen ervaren verschillende emoties ten aanzien van hetzelfde product. Ondanks deze interpersoonlijke verschillen is het proces van emoties, de manier waarop emoties worden opgewekt, universeel. Hoofdstuk 6 introduceert met een algemeen model van productemoties drie parameters die bepalen of een product een emotie opwekt, en zo ja, welke emotie wordt opgewekt (zie figuur 6-2).

De cognitieve, functionele benadering van emoties veronderstelt dat emoties een adaptieve functie hebben. In deze benadering worden emoties gezien als mechanismen die signaleren wanneer gebeurtenissen gunstig dan wel schadelijk zijn voor onze belangen. Dit impliceert dat elke emotie een belang herbergt, een min of meer stabiele voorkeur voor een gegeven gesteldheid. Een product wekt alleen een emotie op als het ofwel correspondeert ofwel botst met een belang. Waarom voel ik me aangetrokken tot een paraplu? Omdat ik een belang heb van 'droog blijven.' En waarom raak ik gefrustreerd van een computer die herhaaldelijk vastloopt? Omdat ik een belang heb van efficiëntie. Het proces van het signaleren van de persoonlijke relevantie van een gebeurtenis wordt meestal omschreven als een 'taxatieproces.' Een taxatie is een automatische non-intellectuele evaluatie van de betekenis van een situatie, waarin onze belangen als referentie optreden.

In hoofdstuk 6 worden de drie parameters geëxploreerd en besproken. Beschreven wordt welke soort belangen en taxaties relevant zijn voor productbeleving, en op welke manier producten kunnen optreden als emotionele stimuli. De parameters combineren tot emotiespecifieke patronen van opwekcondities. Omdat zulke patronen ontwerpers kunnen ondersteunen in het exploreren van de relatie tussen product ontwerp en emotionele reacties, worden ze gedetailleerd behandeld in hoofdstuk 7. Deze exploratie is gebaseerd op experiment 9 waarin respondenten foto's maakten van producten in hun dagelijkse omgeving die gegeven emoties opwekken. Deze studie resulteerde in een database van honderden anekdotische cases, bestaande uit foto's en geschreven beschrijvingen van de oorzaak van de opgewekte emoties. Gevonden werd dat aan de ene kant hetzelfde product veel verschillende



emoties kan opwekken, maar aan de andere kant het onderliggende proces kan worden verklaard met de parameters en hun onderlinge samenhang zoals voorgesteld in hoofdstuk 6.

Verondersteld is dat een ontwerper met deze parameters grip kan krijgen op de emotionele impact van zijn of haar ontwerpen. Hiertoe is de [product & emotie] navigator ontwikkeld (zie figuur 8-3). Dit educatief instrument is een virtuele 'product en emotie ruimte' waarin de productemotie-cases zijn gevisualiseerd. Omdat de [p&e] navigator is bedoeld als instrument ter inspiratie, is de interface ontworpen om een interactie te bewerkstelligen die wordt ervaren als uitdagend, aantrekkelijk, en elegant. De interactie is open en heeft geen begin, einde, of vooraf gedefinieerd zoekpad. Men kan bijvoorbeeld een bepaalde emotie, een bepaald product, of één van de parameters als uitgangspunt nemen voor een [p&e] navigator sessie.

De ontwerpgemeenschap werd met twee workshops actief betrokken bij de ontwikkeling en toepassing van de [p&e] navigator. Het hoofdstuk rapporteert een workshop waarin ontwerpers de parameters hebben gebruikt om 'lichaamsreinigers' te ontwerpen die vooraf gedefinieerde emoties opwekken. Inzichten uit deze workshop zijn toegepast in de ontwikkeling van de [p&e] navigator. In een tweede workshop hebben de deelnemers de [p&e] navigator gebruikt bij het ontwerpen van producten die vooraf gedefinieerde sets van samengestelde emoties opwekken.

#### Algemene discussie

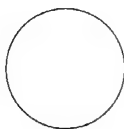
In de discussie worden de toepassingsmogelijkheden van de resultaten beschreven. Zo kunnen de twee hulpmiddelen bijvoorbeeld worden gebruikt om emotionele ontwerpstrategieën te definiëren, om emotionele doelgroepen samen te stellen, of om de emotionele consistentie van de marketinginspanningen van een bedrijf te toetsen. Daarnaast wordt beknopt de relatie tussen emotie en gedrag (tijdens aanschaf, gebruik of bezit) behandeld. Aanbevelingen worden gedaan voor vervolgonderzoek en verdere ontwikkeling van PrEmo en de [p&e] navigator.

Tot slot wordt kort ingegaan op de implicaties van het onderzoek voor de ontwerp-praktijk. Het wordt niet verondersteld dat de hulpmiddelen bedoeld zijn om producten te ontwerpen die uitsluitend aangename emoties opwekken. In plaats daarvan is het misschien een grotere uitdaging om producten te ontwerpen die 'paradoxe emoties' (combinaties van aangename én onaangename emoties) opwekken. In de kunst zijn het vaak juist dergelijke paradoxale emoties waarnaar we zoeken. Wellicht is het voor ontwerpers interessant om het ontwerpen van paradoxale emoties te exploreren omdat dit zou kunnen resulteren in unieke, innovatieve en rijke producten, die gebruikers meer uitdagen dan producten die alleen maar aangename emoties opwekken.

# References

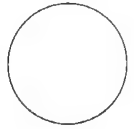


- Aaker, D.A., Stayman, D.M., & Hagerty, M.R. (1986). Warmth in advertising: measurement, impact, and sequence effects. *Journal of Consumer Research*, 12, 365-381.
- Aaker, D.A., Stayman, D.M., & Vezina, R. (1988). Identifying feelings elicited by advertising. *Psychology and Marketing*, 5(1), 1-16.
- Abelson, R.P. (1983). Whatever became of consistency theory? *Personality and Social Psychology Bulletin*, 9, 37-54.
- Aldenderfer, M.S., & Blashfield, R.K. (1989). *Cluster Analysis*. Sage University Paper series on Quantitative Applications in the Social Sciences, 07-044. Newbury Park: Sage.
- Ark, W., Dryer, D.C., & Lu, D.J. (1999). The emotion mouse. *Proceedings of HCI International '99*, Munich Germany, August, 1999.
- Arnold, M.B. (1960). *Emotion and personality: Vol. 1. Psychological aspects*. New York: Colombia University Press.
- Averill, J.R. (1975). A semantical atlas of emotional concepts. *JSAS Catalog of Selected Documents in Psychology*, 5, 330. (Ms. No. 421).
- Averill, J.R. (1980). The emotions. In E. Staub (Ed.), *Personality: Basic aspects and current research* (pp. 134-199). Englewood Cliffs, NJ: Prentice-Hall.
- Averill, J.R., & More, T.A. (2000). Happiness. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (2nd ed.). (pp. 663-678). New York: The Guilford Press.
- Bagozzi, R.P., & Moore, D.J. (1994). Public service advertisements: emotions and empathy guide prosocial behavior. *Journal of Marketing*, 58, 56-70.
- Bagozzi, R.P., Gopinath, M., & Nyer, P.U. (1999). The Role of Emotions in Marketing. *Journal of the Academy of Marketing Science*, 27, 184-206.
- Banise, R., & Scherer, K.R. (1996). Acoustic profiles in vocal emotion expression. *Journal of Personality and Social Psychology*, 70, 614-636.
- Baron, R.A., Byrne, D., & Kantowitz, B.H. (1981). *Psychology, understanding behavior*. New York: Holt, Rinehart and Winston.
- Batra, R., Holbrook, M.B. (1990). Developing a Typology of Affective Responses to Advertising. *Psychology & Marketing*, 7(1), 11-25.
- Belk, R.W. (1988). Possessions and the extended self. *Journal of Consumer Research*, 15, 139-168.
- Belk, R.W. (1989). Extended self and extending paradigmatic perspective. *Journal of consumer research*, 16, 129-132.
- Benson, P.J., & Perrett, D.I. (1991). Perception and recognition of photographic quality facial caricatures: implications for the recognition of natural images. *European Journal of Cognitive Psychology*, 3, 105-135.
- Berlyne, D.E. (1971). Arousal and reinforcement. *Nebraska Symposium on Motivation* (vol. 15, pp. 1-110). Lincoln: University of Nebraska Press.
- Bexton, W.H., Heron, W., & Scott, T.H. (1954). Effects of decreased variation in the sensory environment. *Canadian Journal of Psychology*, 8, 70-76.
- Brinkman, G.A. (1976). Voice Analysis. *Journal of Advertising Research*, 16, 43-48.
- Brinkman, G.A. (1980). Uses of voice-pitch analysis. *Journal of Advertising Research*, 20, 69-73.
- Burns, A., Barrett, R., & Evans, P. (2000). *Delighting customers through emphatic design*. Manuscript submitted for publication.
- Cacioppo J.T., Berntson G.G., Larsen J.T., Poehlmann K.M., & Ito T.A. (2001). The psychophysiology of emotion. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (2nd ed.). (pp. 173-191). New York: The Guilford Press.
- Cacioppo, J.T., & Gardner, W.L. (1999). Emotion. *Annual Review of Psychology*, 50, 191-214.

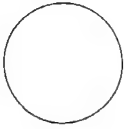


- Cacioppo, J.T., & Petty, R.E. (1989). The elaboration likelihood model: The role of affect and affect-laden information processing in persuasion. In P. Cafferata & A.M. Taybout (Eds.), *Cognitive and affective responses to advertising* (pp. 69-90). Lexington: D.C. Heath and Company.
- Cacioppo, J.T., Bush, L.K., & Tassinari, L.G. (1992). Micro-expressive facial actions as a function of affective stimuli: Replication and extension. *Personality and Social Psychology Bulletin*, 18, 515-526.
- Calder, A.J., Young, A.W., Rowland, D., & Perrett, D.I. (1997). *Computer-enhanced emotion in facial expressions. Proceedings of the Royal Society of London*, 26, 919-925.
- Camras, L.A., Oster, H., Campos, J.J., Miyake, K., & Bradshaw, D. (1992). Japanese and American infants' responses to arm restraints. *Developmental Psychology*, 28, 578-583.
- Carmines, E.G., & Zeller, R.A. (1979). *Reliability and validity assessment*. Sage university paper series on quantitative applications in the social sciences., 07-001. London: Sage publications.
- Carroll, J.M., & Russell, J.A. (1996). Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology*, 70, 205-218.
- Clore, G.L. (1994). Why emotions vary in intensity. In P. Ekman & R.J. Davidson (Eds.), *The Nature of Emotion, fundamental questions* (pp. 386-393). Oxford: Oxford University Press.
- Clore, G.L., Ortony, G.L.A., & Foss, M.A. (1987). The psychological foundations of the affective lexicon. *Journal of Personality and Social Psychology*, 53, 751-755.
- Cornelius, R.C. (1996). *The science of emotions; research and tradition in the psychology of emotion*. New Jersey: Prentice Hall.
- Creusen, M.E.H. (1998). Product appearance and consumer choice. Delft, The Netherlands: Delft University of Technology
- Cupchik, G.C. (1995). Emotion in aesthetics: Reactive and reflective models. *Poetics, Journal of Empirical Research on Literature, the Media, and the Arts*, 23, 177-188.
- Cupchik, G.C. (1999). Emotion and industrial design: reconciling meanings and feelings. In C.J. Overbeeke & P. Hekkert (Eds.), *Proceedings of the international conference Design and Emotion* (pp. 75-82). Delft, The Netherlands: Delft University of Technology.
- Dalkvist, J., & Rollenhagen, C. (1989). Three aspects of emotion awareness: feeling, perceived bodily reaction and cognition. *Reports from the Department of Psychology*, no. 709. Stockholm: University of Stockholm.
- Daly, E.M., Polivy, J., & Lancee, W.J. (1983). A conical model for the taxonomy of emotional experience. *Journal of Personality and Social Psychology*, 45, 443-457.
- Darwin, C. (1872). *The expression of the emotions in man and animals*. London: Murray. (Reprinted, New York: Philosophical Library, 1998).
- Davitz, J.R. (1969). *The language of emotions*. New York: Academic Press.
- DeGooijer, C. (1999). *Validation of PrEmo-4*. Internal report. Delft, The Netherlands: Department of Industrial Design Engineering, Delft University of Technology.
- Derbaix, C.M., & Pham, M.T. (1991). Affective reactions to consumption situations: A pilot investigation. *Journal of Economic Psychology*, 12, 325-355.
- Diener, E., & Lucas, R.E. (2000). Subjective emotional well-being. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions (2nd ed.)*. (pp. 325-337). New York: The Guilford Press.
- Diener, E., Sandvik, E., & Pavot, W. (1991). Happiness is the frequency, not the intensity, of positive versus negative affect. In F. Strack, M. Argyle, & N. Schwartz (Eds.), *Subjective well-being: an interdisciplinary perspective* (pp. 119-139). Oxford: Pergamon Press.
- Dumaine, B. (1991). Design that sells and sells and. *Fortune*, (march 11), 86-94.
- Dune, A., & Raby, F. (2001). *Design Noir: the secret life of electronic objects*. New York: Princeton Architectural Press.

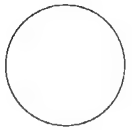




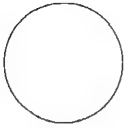
- Eakin, E. (2002, February 23). Penetrating the Mind by Metaphor. *New York Times*.
- Ekman, P. (1971). Universals and cultural differences in facial expressions of emotions. In J.K. Cole (Ed.), *Nebraska Symposium on motivation 1971* (pp. 207-283). Lincoln: University of Nebraska Press.
- Ekman, P. (1984). Expression and the nature of emotion. In K.R. Scherer & P. Ekman (Eds.), *Approaches to Emotion* (pp. 319-344). Hillsdale, NJ: Erlbaum.
- Ekman, P. (1992). Facial expressions of emotion. *Psychological Review*, 99, 550-553.
- Ekman, P. (1994a). All emotions are basic. In P. Ekman & R.J. Davidson (Eds.), *The Nature of Emotion, fundamental questions* (pp. 15-19). Oxford: Oxford University Press.
- Ekman, P. (1994b). Strong evidence for universals in facial expressions: a reply to Russell's mistaken critique. *Psychological Bulletin*, 115(2), 268-287.
- Ekman, P. (1994c). Moods, emotions, and traits. In P. Ekman & R.J. Davidson (Eds.), *The Nature of Emotion, fundamental questions* (pp. 56-58). Oxford: Oxford University Press.
- Ekman, P., & Davidson, R.J. (Eds.). (1994). *The Nature of Emotion, fundamental questions*. Oxford: Oxford University Press.
- Ekman, P., & Friesen, W.V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, 17, 124-129.
- Ekman, P., & Friesen, W.V. (1975). *Unmasking the face: A guide to recognizing emotions from facial cues*. Englewood Cliffs, NJ: Prentice-Hall.
- Ekman, P., & Friesen, W.V. (1978). *Facial Action Coding System: A technique for the measurement of facial movement*. Palo Alto, CA: Consulting Psychologists Press.
- Ekman, P., & O'Sullivan, M. (1987). The role of context in interpreting facial expression: Comment on Russell and Fehr. *Journal of Experimental Psychology, General*, 117, 86-88.
- Ekman, P., Friesen, W.V., & Ellsworth, P. (1982). What emotion categories or dimensions can observers judge from facial behavior? In P. Ekman (Ed.), *Emotion in the human face* (pp. 39-55). Cambridge, UK: Cambridge University Press.
- Ekman, P., Levenson, R.W., & Friesen, W.V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science*, 221, 1208-1210.
- Ellsworth, P.C., & Smith, C.A. (1988). Shades of joy: Patterns of appraisal differentiating pleasant emotions. *Cognition and Emotion*, 2, 301-331.
- Ettcoff, N.L., & Magee, J.J. (1992). Categorical perception of facial expressions. *Cognition*, 44, 227-240.
- Faber, R.J., & Christenson, G.A. (1996). In the mood to buy: Differences in the mood states experienced by compulsive buyers and other consumers. *Psychology and Marketing*, 13, 803-819.
- Fehr, B., & Russell, J.A. (1984). Concept of emotion viewed from a prototype perspective. *Journal of Experimental Psychology*, 113, 464-486.
- Folkman, S., & Lazarus, R.S. (1985). If it changes it must be a process: study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology*, 48, 150-170.
- Ford, M.E. (1992). *Motivating humans*. London, England: Sage Publications.
- Fredrickson, B.L., & Branigan, C. (2001). Positive emotions. In T.J. Mayne & G.A. Bonanno (Eds.), *Emotions, Current Issues and Future Directions* (pp. 123-151). New York: Guilford.
- Frijda, N.H. (1970). Emotion and recognition of emotion. In M.L. Arnold (Ed.), *Feelings and Emotions: The Loyola Symposium* (pp. 251-258). New York: Academic press.
- Frijda, N.H. (1986). *The emotions*. Cambridge: Cambridge University Press.



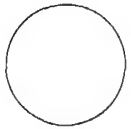
- Frijda, N.H. (1988). The laws of emotion. *American Psychologist*, 43(5), 349-358.
- Frijda, N.H. (1994). Varieties of affect: emotions and episodes, moods, and sentiments. In P. Ekman & R.J. Davidson (Eds.), *The Nature of Emotion, fundamental questions* (pp. 59-67). Oxford: Oxford University Press.
- Frijda, N.H., & Schram, D. (Eds.). (1995). Special issue on emotions and cultural products. *Poetics* (vol. 23).
- Gardner, M. (1985). Mood states and consumer behavior: A critical review. *Journal of consumer research*, 12, 281-300.
- Gazzaniga, M.S. (Ed.). (1995). *The cognitive neurosciences*. Cambridge: MIT Press.
- Gladstones, W.A.H. (1962). A multidimensional study of facial expression of emotion. *Australian Journal of Psychology*, 14, 95-99.
- Goldstein, J.H., & McGhee, P.E. (Eds.). (1972). *The psychology of humor*. New York: Academic Press.
- Green W. & Jordan P. (Eds.) (2002), *Pleasure with Products, beyond usability*. London: Taylor & Francis.
- Grings, W.W., & Dawson, M.E. (1978). *Emotions and bodily responses: a psychophysiological approach*. New York: Academic Press.
- Gutman, J. (1991). Exploring the nature of linkages between consequences and values. *Journal of Business Research*, 22, 146-148.
- Haidt, J., & Keltner, D. (1999). Culture and facial expression: Open ended measures find more faces and a gradient of universality. *Cognition and Emotion*, 13, 225-266.
- Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1995). *Multivariate data analysis*. New York: Macmillan Publishing Company.
- Hanna, G. (1980). A typology of consumer needs. *Research in Marketing*, vol. 3
- Harada, A (Ed.). (2000). Report of modeling the evaluation structure of kansei 2000. Tsukuba: University of Tsukuba.
- Hart, T. (1998). Inspiration: exploring the experience and its meaning. *Journal of Humanistic Psychology*, 38(3), 7-35.
- Hebb, D.O. (1955). Drives and the conceptual nervous system. *Psychological review*, 62, 243-254.
- Hekkert, P., & van Dijk, M. (2001). Designing from context: foundations and applications of the VIP approach. In P. Lloyd & H. Christiaans (Eds.), *Proceedings of the 5th Design Thinking Research Symposium: Designing in Context*. Delft (The Netherlands): Delft University of Technology.
- Hinte, E. van (1997). *Eternally yours; visions on product endurance*. Rotterdam, The Netherlands: 010 Publishers.
- Hirschman, E.C., & Holbrook, M.B. (1982). Hedonic consumption: Emerging concepts, methods and propositions. *Journal of Marketing*, 46, 92-101.
- Holbrook, M.B. (1985) Emotion in the consumption experience: Toward a new model of the human consumer. In R.A. Peterson, W.D. Hoyer, & W.R. Wilson (Eds.), *The role of affect in consumer behavior: Emerging theories and applications*, (pp. 17-52). Lexington, MA: Heath.
- Hume, D. (1888). *A treatise of human nature* (L.A. Selby-Bigge, Ed.). Oxford: Oxford University Press.
- Izard, C.E. (1977). *Human emotions*. New York: Plenum.
- Izard, C.E. (1979). *The Maximally Discriminative Facial Movement Coding System (MAX)*. Newark: Instructional Recourses Center, University of Delaware.
- Izard, C.E. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin*, 115, 288-299.



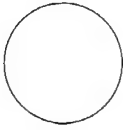
- James, W. (1884). What is an emotion? *Mind*, 19, 188-205.
- James, W. (1894). The physical basis of emotions. *Psychology Review*, 1, 516-529.
- Johnstone, T., & Scherer, K.R. (2001). Vocal communication of emotion. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions (2nd ed.)* (pp. 220-235). New York: The Guilford Press.
- Johnstone, T., Reekum, C.M., & Scherer, K.R. (2001). Vocal expression correlates of appraisal process. In K. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 271-284). Oxford: Oxford University Press.
- Jordan, P.W., Servaes, M. (1995). Pleasure in product use: beyond usability. In S. Robertson (Ed.), *Contemporary Ergonomics 1995*. London: Taylor and Francis.
- Kaiser, S., & Wehrle, T. (1992). Automated coding of facial behavior in human-computer interactions with FACS. *Journal of nonverbal behavior*, 16, 67-83.
- Kaiser, S., Wehrle, T. (2001). Facial expressions as indicators of appraisal processes. In K. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 285-300). Oxford: Oxford University Press.
- Keltner, D., & Ekman, P. (2001). Facial expression of emotion. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions (2nd ed.)* (pp. 236-252). New York: The Guilford Press.
- Keltner, D., & Harker, L.A. (1998). The forms and functions of the nonverbal display of shame. In P. Gilbert & B. Andrews (Eds.), *Interpersonal approaches to shame*. Oxford: Oxford University Press.
- Kivy, P. (1980). *The corded shell; reflections of musical expression*. New Jersey, Princeton: Princeton University Press.
- Kleinginna, P.R., & Kleinginna, A.M. (1981). A categorized list of emotions definitions, with suggestions for a consensual definition. *Motivation and Emotion*, 5, 345-379.
- Kotler, P. (1991). *Marketing Management (5th ed.)*. London, England: Prentice-Hall.
- Laird, J.D., & Bresler, C. (1990). William James and the mechanisms of emotional experience. *Personality and Social Psychology Bulletin*, 16, 636-651.
- Lang, P.J. (1980). Behavioral treatment and bio-behavioral assessment: computer applications. In J.B. Sidowski, J.H. Johnson, & T.A. Williams (Eds.), *Technology in mental health care delivery system* (pp. 129-139). Norwood, NJ: Albex.
- Lazarus, R.S. (1991). *Emotion and Adaptation*. Oxford: Oxford University Press.
- Lazarus, R.S., Kanner, A.D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. In R. Plutchik & H. Kellerman (Eds.), *Theories of emotion, vol. 1: Emotion: theory, research, and experience* (pp. 189-217). New York: Academic Press.
- LeDoux, J.E. (1989). Cognitive-Emotional Interactions in the Brain. *Cognition and Emotion*, 3, 267-289.
- Levenson, R.W., Ekman, P., & Friesen, W. (1990). Voluntary facial expression generates emotion-specific autonomic nervous system activity. *Psychophysiology*, 27, 363-384.
- Leventhal, H., & Scherer, K.R. (1987). The relationship of emotion to cognition: a functional approach to a semantic controversy. *Cognition and Emotion*, 1, 3-28.
- Martin, W., & Tops, G.A.J. (Eds.). (1986). *Van Dale, groot woordenboek Engels-Nederlands*. Utrecht: Van Dale Lexicografie.
- Maslow, A. (1943). A theory of human motivation. *Psychological Review*, 50, 370-396.
- May, R. (1975). *The courage to create*. New York: Bantam.
- Mehrabian, A., & Russell, J.A. (1977). Evidence for a three-factor theory of emotions. *Journal of Research in Personality*, 11, 273-294.



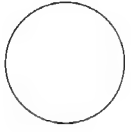
- Meijer, M. (1989). The contribution of general features of body movement to the attribution of emotion. *Journal of Nonverbal Behavior*, 13, 247-269.
- Motley, M.T., & Camden, C.T. (1988). Facial expression of emotion: a comparison of posed expressions versus spontaneous expressions in an interpersonal communication setting. *Western Journal of Speech Communication*, 52, 1-22.
- Murray, H.A. (1938). *Explorations in personality*. New York: Oxford University Press.
- Nelson, C.A., & de Haan, M. (1997). A neurobehavioral approach to the recognition of facial expression in infancy. In J.A. Russell, & J.M. Fernandez-Dols (Eds.), *The psychology of Facial Expressions* (pp. 176-204). Cambridge: Cambridge University Press.
- Oatly, K., & Duncan, E. (1992). Structured diaries for emotions in daily life. In K.T. Strongman (Ed.), *International review of studies in emotion*, (vol. 2, pp. 250-293). Chichester, England: Wiley.
- Ortony, A., & Turner, T.J. (1990). What's basic about basic emotions? *Psychological review*, 97, 315-331.
- Ortony, A., Clore, G.L., & Collins, A. (1988). *The cognitive structure of emotions*. Cambridge: Cambridge University Press.
- Ortony, A., Clore, G.L., & Foss, M.A. (1987). The referential structure of the affective lexicon. *Cognitive Science*, 11, 341-364.
- Overbeeke, C.J., & Hekkert, P. (Eds.). (1999). *Proceedings of the international conference Design and Emotion*. Delft, The Netherlands: Delft University of Technology.
- Picard, R.W. (1997). *Affective computing*. Cambridge: MIT Press.
- Picard, R.W. (2000). Toward computers that recognize and respond to user emotion. *IBM Systems Journal*, 39(3&4).
- Picard, R.W. (2001). Building HAL: computers that sense, recognize, and respond to human emotion. *Human Vision and Electronic Imaging VI, Electronic Imaging*, 21-26 January 2001, San Jose CA.
- Plutchik, R. (1980). *Emotion: A psychoevolutionary synthesis*. New York: Harper & Row.
- Plutchik, R. (1993). Emotions and their vicissitudes: emotions and the psychopathology. In M. Lewis & J.M. Haviland (Eds.), *Handbook of Emotions* (pp. 53-65). New York: Guilford.
- Polzin, T. (2000). *Detecting verbal and nonverbal cues in the communication of emotions*. Carnegie Mellon: School of Computer Science.
- Rhodes, G., Brennan, S.E., & Carey, S. (1987). Identification and ratings of caricatures: implications for mental representations of faces. *Cognitive Psychology*, 19, 473-497.
- Richins, M.L. (1997). Measuring emotions in the consumption experience. *Journal of Consumer Research*, 24, 127-146.
- Riskind, J.H. (1984). They stoop to conquer: Guiding and self-regulatory functions of physical posture after success and failure. *Journal of Personality and Social Psychology*, 47, 479-493.
- Rokeach, M. (1968). *Beliefs, attitudes, and values: a theory of organization and change*. San Francisco: Jossey-Bass.
- Roseman, I.J. (1984). Cognitive determinants of emotion. In P. Shaver (Ed.), *Review of Personality and Social Psychology* (vol. 5, pp. 11-36). Beverly Hills: Sage.
- Roseman, I.J. (1991). Appraisal determinants of discrete emotions. *Cognition and emotion*, 5, 161-200.
- Roseman, I.J. (2001). A model of appraisal in the emotion system: integrating theory, research, and applications. In K. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 68-91). Oxford: Oxford University Press.



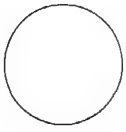
- Roseman, I.J., & Smith, G.A. (2001). Appraisal theory: assumptions, varieties, controversies. In K. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 3-19). Oxford: Oxford University Press.
- Roseman, I.J., Antoniou, A.A., Jose, P.E. (1996). Appraisal determinants of emotions: Constructing a more accurate and comprehensive theory. *Cognition and Emotion*, vol. 10, (3), 241-277.
- Roseman, I.J., Spindel, M.S., & Jose, P.E. (1990). Appraisal of emotion-eliciting events: Testing a theory of discrete emotions. *Journal of Personality and Social Psychology*, 59, 899-915.
- Rosenthal, R., Hall, J.A., DiMatteo, M.R., Rogers, P.L., & Archer, D. (1979). *Sensitivity to nonverbal communication: The PONS test*. Baltimore: Johns Hopkins University Press.
- Rothbart, M.K. (1973). Laughter in young children. *Psychology Bulletin*, 80, 245-256.
- Rozin, P., & Fallon, A.E. (1987). A perspective on disgust. *Psychological Review*, 94(1), 23-41.
- Rozin, P., Haidt, J., & McCauley, C.R. (2000). Disgust. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (2nd ed.). (pp. 637-653). New York: The Guilford Press.
- Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*, 50, 703-712.
- Ruch, W. (1992). Assessment of appreciation of humor: Studies with the 3 WD humor test. In C.D. Spielberger & J.N. Butcher (Eds.), *Advances in personality assessment* (vol. 9, pp. 27-75). Hillsdale, NJ: Erlbaum.
- Ruch, W. (1993). Exhilaration and Humor. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (pp. 53-65). New York: Guilford.
- Russell, J.A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39, 1161-1178.
- Russell, J.A. (1989). Measures of emotion. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research and experience* (vol. 4, pp. 83-111). New York: Academic Press.
- Russell, J.A. (1994). Is there universal recognition of emotion from facial expression? A review of cross-cultural studies. *Psychological Bulletin*, 115(1), 102-141.
- Scherer, K.R. (1982). Emotion as a process: function, origin, and regulation. *Social Science Information*, 21, 555-570.
- Scherer, K.R. (1984). On the nature of emotion: a component process approach. In K.R. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 293-317). Hillsdale, NJ: Erlbaum.
- Scherer, K.R. (1986). Studying emotion empirically: issues and a paradigm for research. In K.R. Scherer, H.G. Wallbott, & A.B. Summerfield (Eds.), *Experiencing emotion: a cross-cultural study* (pp. 3-27). Cambridge: Cambridge University Press.
- Scherer, K.R. (1988). Criteria for emotion-antecedent appraisal: a review. In V. Hamilton, G.H. Bower, & N.H. Frijda (Eds.), *Cognitive perspectives on emotion and motivation: Vol. 44. NATO ASI series D: Behavioural and social sciences* (pp. 89-126). Dordrecht, Netherlands: Kluwer.
- Scherer, K.R. (1989). Vocal correlates of emotion. In H. Papoušek, U. Jürgens, & M. Papoušek (Eds.), *Nonverbal vocal communication* (pp. 43-62). Cambridge: Cambridge University Press.
- Scherer, K.R. (1999). Appraisal theory. In T. Dalgeis & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 637-663). London: Wiley.
- Scherer, K.R. (2001). Appraisal considered as a process of multilevel sequential checking. In K. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 92-120). Oxford: Oxford University Press.
- Schubert, E. (1996). Two dimensional space for measuring subjective emotional response – a pilot study. Paper presented at the XIV Congress of the international Association of Empirical Aesthetics, Academy of Sciences of the Czech Republic, Prague.



- Schwartz, S.H. (1992). Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, 25, 1-65.
- Shaver, P., Schwartz, J., Kirson, D., & O'Conner C. (1987). Emotion knowledge: further exploration of a prototype approach. *Journal of Personality and Social Psychology*, 52(6), 1061-1086.
- Smith, C.A., & Ellsworth, P.C. (1985). Patterns of cognitive appraisal in emotion. *Journal of Personality and Social Psychology*, 48, 813-838.
- Smith, C.A., & Ellsworth, P.C. (1987). Patterns of appraisal and emotion related to taking an exam. *Journal of Personality and Social Psychology*, 52, 475-488.
- Smith, C.A., & Lazarus, R.S. (1993). Appraisal components, core relational themes, and the emotions. *Cognition and Emotion*, 7, 223-269.
- Stayman, D.M., & Aaker, D.A. (1988). Are all effects of ad-induced feelings mediated by attitude towards the ad? *Journal of Consumer Research*, 15, 368-373.
- Strack, F., Stepper, S., & Martin, L.L. (1988). Inhibiting and facilitating conditions of the human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology*, 16, 319-328.
- Tan, A.H.L. (1995a). *Gebruikershandleiding PEL-Panel*. Delft, The Netherlands: Delft University of Technology (in Dutch).
- Tan, E.S.H. (1995b). Film-induced affect as a witness emotion. *Poetics*, 23, 7-32.
- Tan, E.S.H. (2000). Emotion, art, and the humanities. In M. Lewis & J.M. Haviland-Jones (Eds.), *Handbook of Emotions* (2nd ed.). (pp. 116-134). New York: The Guilford Press.
- Thackara, J. (1997). *Winners: how succesful companies innovate by design*. Amsterdam, The Netherlands: BIS.
- Titchener, E.B. (1908). *Lectures on the elementary psychology of feeling and attention*. New York: Macmillan.
- Tomkins, S.S. (1984). Affect theory. In K.R. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 163-196). Hillsdale NJ: Erlbaum.
- Vrana, S.R. (1993). The psychophysiology of disgust: Differentiating negative emotional contexts with facial EMG. *Psychophysiology*, 30, 279-286.
- Wallbott, H.G. (1998a). Bodily expression of emotion. *European Journal of Social Psychology*, 28, 879-896.
- Wallbott, H.G. (1998b). Decoding emotions from facial expression: Recent developments and findings. *European Review of Social Psychology*, 9, 191-232.
- Wallbott, H.G., & Scherer, K.R. (1986). Cues and channels in emotion recognition. *Journal of Personality and Social Psychology*, 51, 690-699.
- Watson, D., & Clarck, L.A., (1994). Emotions, moods, traits, and temperaments: conceptual distinctions and empirical findings. In P. Ekman & R.J. Davidson (Eds.), *The Nature of Emotion, fundamental questions* (pp. 89-93). Oxford: Oxford University Press.
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, 3, 1-14.
- Watson, J.B. (1930). *Behaviorism*. Chicago: University of Chicago Press.
- Weisfeld, G.E., & Beresford, J.M. (1982). Erectness of posture as an indicator of dominance or success in humans. *Motivation and Emotion*, 6, 113-131.
- Wensveen, S.A.G., Overbeeke, C.J., & Djajadiningrat, J.P. (2002). *Push Me, Shove Me and I Show You How You Feel. Recognizing Mood from Emotionally Rich Interaction*. Manuscript submitted for publication.
- Westbrook, R.A. (1987). Consumption based affective responses and post purchase processes. *Journal of marketing research*, 24, 258-270.



- Westbrook, R.A., & Oliver, R.L. (1991). The dimensionality of consumption emotion patterns and consumer satisfaction. *Journal of consumer Research*, 18, 84-91.
- Wiles, J.A., & Cornwell, T.B. (1990). A review of methods utilized in measuring affect, feelings, and emotions in advertising. *Current Issues and Research in Advertising*, 13, 241-275.
- Williams, C.E., & Stevens, K.N. (1972). Emotions and speech: Some acoustical correlates. *Journal of the Acoustical Society of America*, 52, 1238-1250.
- Williams, M.E. (1982). *Inspiration in Milton and Keats*. Totowa, NJ: Barnes & Noble.
- Wundt, W. (1905). *Fundamentals of psychology* (7th ed.). Leipzig: Engelman.
- Young, P.T. (1973). Feeling and emotion. In B.B. Wolman (Ed.), *Handbook of general psychology*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Zajonc, R.B. (1980). Feeling and Thinking. Preferences need no inferences. *American Psychologist*, 35, 151-175.
- Zajonc, R.B. (1984). On the primacy of affect. *American Psychologist*, 39, 117-123.
- Zuckerman, M. (1979). *Sensation seeking*. Hillsdale, NJ: Erlbaum.
- Zuckerman, M., Hall, J.A., DeFrank, R.S., & Rosenthal, R. (1976). Encoding and decoding of spontaneous and posed facial expressions. *Journal of Personality and Social Psychology*, 34, 966-977.





# Appendix 1

## Emotion words used in Study 1 and 2



### Appendix 1-1 Classification of 347 (Dutch) emotion words

#### Octant 1:

Dolzinnig; enthousiast; euforisch; extatisch; geestdriftig; geïnspireerd; gepassioneerd; geweldig; groots; hartstochtelijk; hitsig; krachtig; kwiek; levendig; lustig; opgepept; opgewonden; oppermachtig; passioneel; smachtend; superieur; uitbundig; uitzinnig; verlangend; verliefd; verlustigd; verrukt; vurig; wellustig; zegevierend.

#### Octant 2:

Aanbeden; aangehaald; aangenaam verrast; aangetrokken tot; aardig; behaagd; bekoord; bewonderd; blij; bloeiend; geadoreerd; geamuseerd; geboeid; geestig; geïnteresseerd; gelukkig; gestreeld; geveid; gezellig; goedgehumeurd; goedgeluimd; helder; hoopvol; innig; intiem; monter; onbezorgd; opgekapt; opgelucht; opgevrolijkt; oprecht; plezierig; prettig; sexy; sterk; succesvol; trots; uitzien naar; verblijd; verheugd; verleid; verlekkerd; verlicht; vermaakt; voorspoedig; vreugdevol; vrolijk; waarderend; welbehaaglijk; welvarend; welwillend; wulps; zwoel.

#### Octant 3:

Aanvaardend; behaaglijk; beschermd; beschut; geriefelijk; gerustgesteld; goedkeurend; knus; liefelijk; ontspannen; respectvol; teder; tevreden; trouwhartig; vertederd; vertrouwd; voldaan; vredig; vriendelijk; warm; zacht; zachtaardig; zachtzinnig; zoet.

#### Octant 4:

Afwachtend; bedaard; bedeesd; broos; eerbiedig; kalm; nederig; passief; rustig; soft; stil; timide; verlegen; voorkomend.

#### Octant 5:

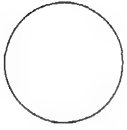
Afgemat; bedremmeld; bedrukt; berooid; beschroomd; beteuterd; bitter; buitengesloten; depressief; droefgeestig; eenzaam; gepest; hopeloos; kwetsbaar; lafhartig; machteloos; mistroostig; moe; onderdanig; ontgoocheld; ontmoedigd; rouwig; somber; treurig; vermoeid; verslagen; verslapt; verveeld; verzuchtend; vleugellam; week; weemoedig; zwaarmoedig; zwak.

#### Octant 6:

Aangedaan; afgunstig; afkerend; afkerig; afwijzend; bedroefd; behoeftig; beklemd; belemmerd; benadeeld; beroerd; berouwvol; beschaamd; betrapt; bevreesd; bezorgd; chagrijnig; cynisch; gegriefd; gehinderd; gekrenkt; gekwetst; gesnapt; gestremd; getroffen; hailerig; huiverig; humeurig; jaloers; jammerlijk; koppig; minachtend; misgund; naargeestig; onaardig; ongelukkig; ongerust; onrustig; onstabiel; ontevreden; onzeker; opgelaten; pijnlijk; prikkelbaar; sarcastisch; schaamtevol; schuldig; schuw; stug; teleurgesteld; troosteloos; verbeteren; verbitterd; verbolgen; verbouwereerd; verdrietig; vernederd; verstoord; vertwijfeld; verworpen; zuur.

#### Octant 7:

Agressief; angstig; bang; beledigd; boos; boosaardig; doorgeslagen; driftig; geagiteerd;



gealarmeerd; geërgerd; gefrustreerd; geïrriteerd; gemeen; gepijnigd; geschrokken; gestresst; getreiterd; hatelijk; in paniek; inhalig; krankzinnig; kwaad; nerveus; nijdig; ontdaan; onthutst; ontsteld; ontzet; opgehitst; opgestookt; radeloos; razend; toornig; van streek; verachtend; verbijsterd; verontwaardigd; verpletterd; vijandig; vreesachtig; walgend; wanhopig; woedend; woest; zenuwachtig.

#### **Octant 8:**

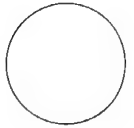
Actief; alert; anticiperend; begerig; geconcentreerd; geprikkeld; gloeiend; gretig; gulzig; happig; hebzuchtig; nieuwsgierig; turbulent; verantwoordelijk; verbaasd; verbluft; verrast; verwoed; verwonderd; wild.

#### **Words that do not refer to emotions but to external states or non-mental states:**

Aandoenlijk; aanlokt; bedenkelijk; beducht; beduusd; behoed; bekommerd; benauwd; benepen; bevangen; bevreemd; bewogen; brutaal; gegrepen; geil; gekalmeerd; gelauwerd; gelovig; geraakt; geroerd; gestoord; gevoelig; grotesk; halsstarrig; hebberig; hilarisch; hunkerend; hyperactief; kras; loyaal; melancholisch; ontroerd; ontvankelijk; peinzend; sentimenteel; sereen; teergevoelig; teerhartig; tierig; uitgeput; vatbaar; verheven; verhinderd; verraden; verslaafd; verstomd; vervoerd; verward; verweerd; verwittigd; voor de gek gehouden; weeïg; weerbarstig; wensend.

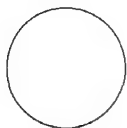
#### **Unfamiliar words:**

Achtend; belust; eenkennig; erbarmen; fiductief; geducht; getrouw; nooddruftig; opgekalefaterd; welgevallen; zachtmoedig.

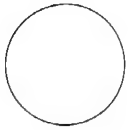


## Appendix 1-2 Sum-scores of emotion words used in Study 2

<b>Pleasant Excited</b>		<i>Prettig</i>	10	<i>Vertederd</i>	24	<i>Kwetsbaar</i>	14
<i>Enthousiast</i>	72	<i>Helder</i>	9	<i>Knus</i>	23	<i>Machteloos</i>	13
<i>Geïnspireerd</i>	64	<i>Verleid</i>	9	<i>Vertrouwd</i>	19	<i>Beteuterd</i>	13
<i>Verlangend</i>	52	<i>Goedgehumeurd</i>	7	<i>Vredig</i>	16	<i>Droefgeestig</i>	12
<i>Opgewonden</i>	31	<i>Goedgeluimd</i>	4	<i>Gerustgesteld</i>	14	<i>Verzuchtend</i>	11
<i>Verliefd</i>	22	<i>Hoopvol</i>	4	<i>Warm</i>	13	<i>Berooid</i>	11
<i>Geweldig</i>	16	<i>Innig</i>	4	<i>Zachtaardig</i>	8	<i>Afgemat</i>	11
<i>Uitbundig</i>	13	<i>Succesvol</i>	3	<i>Beschut</i>	7	<i>Eenzaam</i>	5
<i>Krachtig</i>	9	<i>Intiem</i>	3	<i>Beschermd</i>	6	<i>Hopeloos</i>	4
<i>Levendig</i>	9	<i>Plezierig</i>	3	<i>Geriefelijk</i>	5	<i>Onderdanig</i>	4
<i>Opgepept</i>	9	<i>Sterk</i>	2	<i>Liefelijk</i>	2	<i>Verslagen</i>	4
<i>Superieur</i>	8	<i>Uitziend naar</i>	2	<i>Zacht</i>	1	<i>Bedrukt</i>	3
<i>Euforisch</i>	6	<i>Opgevrolijkt</i>	2	<i>Zoet</i>	1	<i>Depressief</i>	3
<i>Oppermachtig</i>	6	<i>Oprecht</i>	1	<i>Aanvaardend</i>	0	<i>Week</i>	3
<i>Passioneel</i>	4	<i>Trots</i>	1	<i>Goedkeurend</i>	0	<i>Zwaarmoedig</i>	2
<i>Lustig</i>	3	<i>Verlicht</i>	1	<i>Respectvol</i>	0	<i>Gepest</i>	1
<i>Verlustigd</i>	3	<i>Zwoel</i>	1	<i>Teder</i>	0	<i>Bedremmeld</i>	0
<i>Dolzinnig</i>	1	<i>Aanbeden</i>	0	<i>Trouwhartig</i>	0	<i>Beschroomd</i>	0
<i>Extatisch</i>	1	<i>Aangehaald</i>	0	<i>Vriendelijk</i>	0	<i>Bitter</i>	0
<i>Zegevierend</i>	1	<i>Aardig</i>	0	<i>Zachtzinnig</i>	0	<i>Lafhartig</i>	0
<i>Geestdriftig</i>	0	<i>Behaagd</i>	0			<i>Ontmoedigd</i>	0
<i>Gepassioneerd</i>	0	<i>Bekoord</i>	0	<b>Neutral Calm</b>		<i>Rouwig</i>	0
<i>Groots</i>	0	<i>Bloeiend</i>	0	<i>Kalm</i>	55	<i>Treurig</i>	0
<i>Hartstochtelijk</i>	0	<i>Geadoreerd</i>	0	<i>Passief</i>	54	<i>Verslapt</i>	0
<i>Hitsig</i>	0	<i>Geïnteresseerd</i>	0	<i>Rustig</i>	53	<i>Vleugellam</i>	0
<i>Kwiek</i>	0	<i>Gestreeld</i>	0	<i>Afwachtend</i>	51	<i>Zwak</i>	0
<i>Smachtend</i>	0	<i>Gevleid</i>	0	<i>Stil33</i>			
<i>Uitzinnig</i>	0	<i>Monter</i>	0	<i>Eerbiedig</i>	27	<b>Unpleasant Average</b>	
<i>Verrukt</i>	0	<i>Onbezorgd</i>	0	<i>Bedaard</i>	17	<i>Afwijzend</i>	57
<i>Vurig</i>	0	<i>Opgeknapt</i>	0	<i>Bedeest</i>	13	<i>Teleurgesteld</i>	40
<i>Wellustig</i>	0	<i>Opgelucht</i>	0	<i>Verlegen</i>	8	<i>Minachtend</i>	35
		<i>Sexy</i>	0	<i>Soft</i>	7	<i>Jaloers</i>	29
<b>Pleasant Average</b>		<i>Verblijd</i>	0	<i>Voorkomend</i>	4	<i>Afkerend</i>	22
<i>Aangetrokken tot</i>	36	<i>Verheugd</i>	0	<i>Broos</i>	3	<i>Ontevreden</i>	17
<i>A. verrast</i>	33	<i>Voorspoedig</i>	0	<i>Nederig</i>	3	<i>Verstoord</i>	14
<i>Geboeid</i>	33	<i>Vreugdevol</i>	0	<i>Timide</i>	2	<i>Sarcastisch</i>	12
<i>Geamuseerd</i>	26	<i>Welbehaaglijk</i>	0			<i>Verbouwereerd</i>	11
<i>Waarderend</i>	25	<i>Welvarend</i>	0	<b>Unpleasant Calm</b>		<i>Gehinderd</i>	9
<i>Vermaakt</i>	18	<i>Welwillend</i>	0	<i>Verveeld</i>	65	<i>Humeurig</i>	7
<i>Gelukkig</i>	18	<i>Wulps</i>	0	<i>Somber</i>	33	<i>Chagrijnig</i>	7
<i>Bewonderd</i>	15			<i>Ontgoocheld</i>	26	<i>Cynisch</i>	7
<i>Geestig</i>	13	<b>Pleasant Calm</b>		<i>Moe</i>	23	<i>Opgelaten</i>	5
<i>Gezellig</i>	13	<i>Tevreden</i>	65	<i>Vermoeid</i>	20	<i>Onzeker</i>	5
<i>Verlekkerd</i>	12	<i>Ontspannen</i>	53	<i>Buitengesloten</i>	19	<i>Onstabiel</i>	5
<i>Vrolijk</i>	12	<i>Behaaglijk</i>	49	<i>Mistroostig</i>	17	<i>Vertwijfeld</i>	4
<i>Blij 10</i>		<i>Volgaan</i>	24	<i>Weemoedig</i>	14	<i>Troosteloos</i>	4

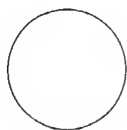


		<b>Upleasant Excited</b>	<b>Neutral Excited</b>
Belemmerd	4		
Behoeftig	4	<i>Geïrriteerd</i>	<i>Nieuwsgierig</i> 83
Prikkelbaar	3	<i>Geërgerd</i>	<i>Verwonderd</i> 44
Ongelukkig	3	<i>Walgend</i>	<i>Verbaasd</i> 38
Huiverig	3	<i>Verachtend</i>	<i>Hebzuchtig</i> 32
Bezorgd	3	<i>Verontwaardigd</i>	<i>Geprikkeld</i> 28
Afkerig	3	<i>Verbijsterd</i>	<i>Begerig</i> 27
Aangedaan	3	<i>Geschrokken</i>	<i>Geconcentreerd</i> 17
Zuur	2	<i>Gefrustreerd</i>	<i>Verbluft</i> 16
Onrustig	2	<i>Inhalig</i>	<i>Gretig</i> 12
Naargeestig	2	<i>Agressief</i>	<i>Alert</i> 11
Misgund	2	<i>Zenuwachtig</i>	<i>Actief</i> 8
Getroffen	2	<i>Vijandig</i>	<i>Gulzig</i> 6
Afgunstig	2	<i>Gealarmeerd</i>	<i>Happig</i> 4
Verbitterd	1	<i>Geagiteerd</i>	<i>Turbulent</i> 2
Bedroefd	1	<i>Kwaad</i>	<i>Verantwoordelijk</i> 1
Verworpen	0	<i>Beledigd</i>	<i>Wild</i> 1
Vernederd	0	<i>Nerveus</i>	<i>Anticiperend</i> 0
Verdrietig	0	<i>Boosaardig</i>	<i>Gloeiend</i> 0
Verbolgen	0	<i>Ontzet</i>	<i>Verrast</i> 0
Verbeten	0	<i>Ontsteld</i>	<i>Verwoed</i> 0
Stug	0	<i>Radeloos</i>	
Schuw	0	<i>Van streek</i>	
Schuldig	0	<i>Krankzinnig</i>	
Schaamtevol	0	<i>Woest</i>	
Pijnlijk	0	<i>Opgehitst</i>	
Ongerust	0	<i>Ontdaan</i>	
Onaardig	0	<i>Gestresst</i>	
Koppig	0	<i>Vreesachtig</i>	
Jammerlijk	0	<i>Wanhopig</i>	
Huilerig	0	<i>Angstig</i>	
Gestremd	0	<i>Bang</i>	
Gesnapt	0	<i>Boos</i>	
Gekwetst	0	<i>Doorgeslagen</i>	
Gekrenkt	0	<i>Driftig</i>	
Gegriefd	0	<i>Gemeen</i>	
Bevreesd	0	<i>Gepijnigd</i>	
Betrapt	0	<i>Getreiterd</i>	
Beschaamd	0	<i>Hatelijk</i>	
Berouwvol	0	<i>In paniek</i>	
Beroerd	0	<i>Nijdig</i>	
Benadeeld	0	<i>Onthutst</i>	
Beklemd	0	<i>Opgestookt</i>	
		<i>Razend</i>	
		<i>Toornig</i>	
		<i>Verpletterd</i>	
		<i>Woedend</i>	



## Appendix 1-3 Dutch-English translations

Dutch	English	Dutch	English
Aangenaam verrast	Pleasantly surprised	Kwetsbaar	Vulnerable
Aangetrokken tot	Attracted to	Machteloos	Powerless
Afgemat	Exhausted	Minachtend	Contempt
Afkerend	Aversion	Mistroostig	Gloomy
Afwachtend	Awaiting	Moe	Tired
Afwijzend	Disapprove-of	Nieuwsgierig	Curious
Agressief	Aggressive	Ontevreden	Dissatisfied
Alert	Alert	Ontgoocheld	Disillusioned
Bedaard	Composed	Ontspannen	Relaxed
Bedeeld	Timid	Opgewonden	Excited
Begerig	Longing	Passief	Passive
Behaaglijk	Comfortable	Prettig	Pleasant
Berooid	Destitute	Rustig	Tranquil
Beteuterd	Taken aback	Sarcastisch	Sarcastic
Bewonderd	Admiring	Somber	Sad
Blij	Joyful	Stil	Quiet
Buitengesloten	Isolated	Teleurgesteld	Disappointed
Chagrijnig	Grouchy	Tevreden	Satisfied
Cynisch	Cynical	Uitbundig	Jubilant
Droefgeestig	Cheerless	Verachtend	Despise
Eerbiedig	Deferent	Verbaasd	Amazed
Enthousiast	Enthusiastic	Verbijsterd	Bewildered
Gealarmeerd	Alarmed	Verbluft	Astonished
Geamuseerd	Amused	Verbouwereerd	Flabbergasted
Geboeid	Fascinated	Verlangend	Desiring
Geconcentreerd	Concentrated	Verlekkerd	Appetitive
Geërgerd	Annoyed	Verliefd	Loving
Geestig	Funny	Vermaakt	Entertained
Gefrustreerd	Frustrated	Vermoeid	Fatigued
Gehinderd	Irked	Verontwaardigd	Indignant
Geïnspireerd	Inspired	Verstoord	Disturbed
Geïrriteerd	Irritated	Vertederd	Softened
Gelukkig	Happy	Vertrouwd	Intimate
Geprikkeld	Stimulated	Verveeld	Bored
Gerustgesteld	Reassured	Verwonderd	Surprised
Onaangenaam verrast	Unpleasant surprise	Verzuchtend	Sighing
Geweldig	Terrific	Vijandig	Hostile
Gezellig	Sociable	Voldaan	Fulfilled
Gretig	Eager	Vredig	Peaceful
Hebzuchtig	Avaricious	Vrolijk	Cheerful
Humeurig	Moody	Waarderend	Appreciate
Inhalig	Greedy	Walgend	Disgusted
Jaloers	Jealous	Warm	Warm
Kalm	Calm	Weemoedig	Melancholy
Knus	Cosy	Zenuwachtig	Nervous



# Appendix 2

## Six versions of PrEmo; a design report



This appendix reports the development of the Product Emotion Measurement Instrument (PrEmo). In total six versions have been developed. Prototypes have been made of all concepts, and these prototypes have been evaluated in explorative application studies. The studies performed with PrEmo-1 to 5 are reported only briefly. The studies performed with PrEmo-6 are reported in detail in Chapter 3, 4, and 5 of this thesis.

### A2-1 PrEmo-1

#### Starting-points

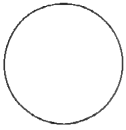
PrEmo-1 (Figure A2-1) was developed in May 1997. At this early stage in the project, the first three demands that should be met by the instrument (i.e. measuring distinct, and mixed emotions, often elicited by product appearance) had not yet been defined. Instead, a dimensional view on emotions was adopted. As a result, PrEmo-1 was based on the two most commonly found emotional dimensions: 'pleasantness' and 'activation.' An often-applied instrument that measures these dimensions is the Self Assessment Manikin (SAM; Lang, 1980; see Section 3.2 in Chapter 3). An important limitation of SAM is that it forces subjects to report their emotions in separate dimensions. PrEmo-1 was designed to overcome this disadvantage by using line-drawn faces that *combine* differentiated levels of the two dimensions. It was decided to use line drawings because that enabled us to leave out distracting irrelevant information (e.g. hairstyle and age; see discussion in Section 3.5).

#### Development

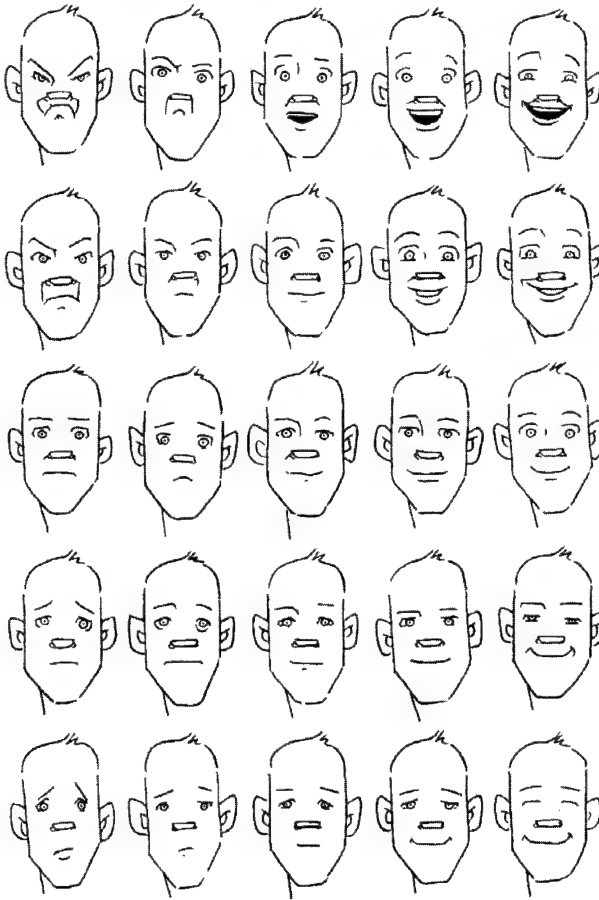
With the dimensions pleasantness and activation, a 5 x 5 matrix was created. Each cell contains a face that represents the pleasantness and activation levels of this specific location in the matrix. These faces were drawn by a professional cartoon artist. First, he drew (male) faces to fill the corner-cells. Subsequently, he drew four faces for each of the remaining 21 cells. A selection from the four alternatives per cell was based on a study with 15 participants. For this study, the 84 alternative faces were printed on small cards. Participants were given a 5 x 5 matrix that was empty except for the four corners. Participants were instructed to select 21 of the 84 faces to fill the matrix. Based on the frequency of selection, the final choice was made. For each cell, the face was chosen that had been selected by the largest amount of participants. Subsequently, of the selected faces, the cartoon artist drew a second, female, version.

#### Evaluation

The prototype of PrEmo-1 was evaluated in a small explorative study. Ten participants were instructed to use PrEmo-1 to (individually) express their emotional response towards six (pictures of) kettles. They were allowed use either the female



**Figure A2-1** Interface *PrEmo*; version 1.

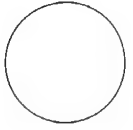


A computer interface depicts 25 line-drawn faces arranged in a 5 x 5 matrix. The expressions of these faces differ in 'pleasantness' and 'activation.' The horizontal axis represents pleasantness (left = unpleasant; right = pleasant), and the vertical axis represents activation (bottom = calm; top = excited). The interface operates in a 'pop up' fashion: the faces are made visible by scrolling the mouse pointer over the cells. Participants report their emotional response by selecting the face that best expresses this response. Both a male and a female version of *PrEmo*-1 were designed.

or the male version. After finishing the task, in an informal interview, participants evaluated their experiences.

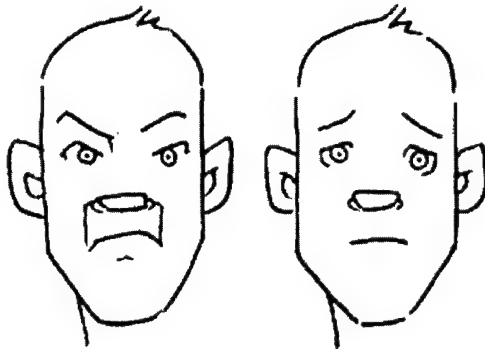
Participants were enthusiastic about not having to verbalise their emotions. By avoiding words, *PrEmo*-1 was both fast and intuitive in use. Moreover, participants reported that the task was not difficult and even pleasurable. Besides this strength, the assessment also revealed two important shortcomings. First, participants reported that in some cases they were frustrated by the fact that they were allowed to select only one face. In those cases they felt a mixture of, for example, pleasant and unpleasant emotions. There was no possibility to report these 'mixed' emotions. Second, although the faces are drawn with the goal to represent –only– the two





**Figure A2-2 Dimensional expressions; two PrEmo-1 faces.**

These examples illustrate that the PrEmo-1 faces express more than merely levels of pleasantness and activation. The face on the left appears to express anger, whereas the face on the right appears to express some kind of sadness.



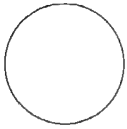
dimensions, it proved to be impossible not to include other information in the drawings as well. For example, it was not possible to draw a face that expresses 'activated-unpleasant' without it expressing either *anger* or *fear* or any other distinct activated-unpleasant emotion (see Figure A2-2).

Participants repeatedly commented on the expression on the faces (e.g. "this face looks angry," or, "he looks like somebody hurt his feelings," etcetera). It seems human nature to interpret facial expressions in terms of distinct emotions. This finding corresponds with the findings of Etcoff and Magee (1992) who found that "people cannot help but see the face as showing one or another kind of emotion."

Besides the strengths and shortcoming, two more findings emerged from the evaluations. First, no preference for either the male or female version was reported (by neither male nor female participants). In fact, most participants were *confused* by the fact they had to choose for one of the two versions. As they did not understand why they had to choose, some even suspected that it was part of the test. All participants agreed that a single version would have been sufficient (and none reported to prefer either the male or female version).

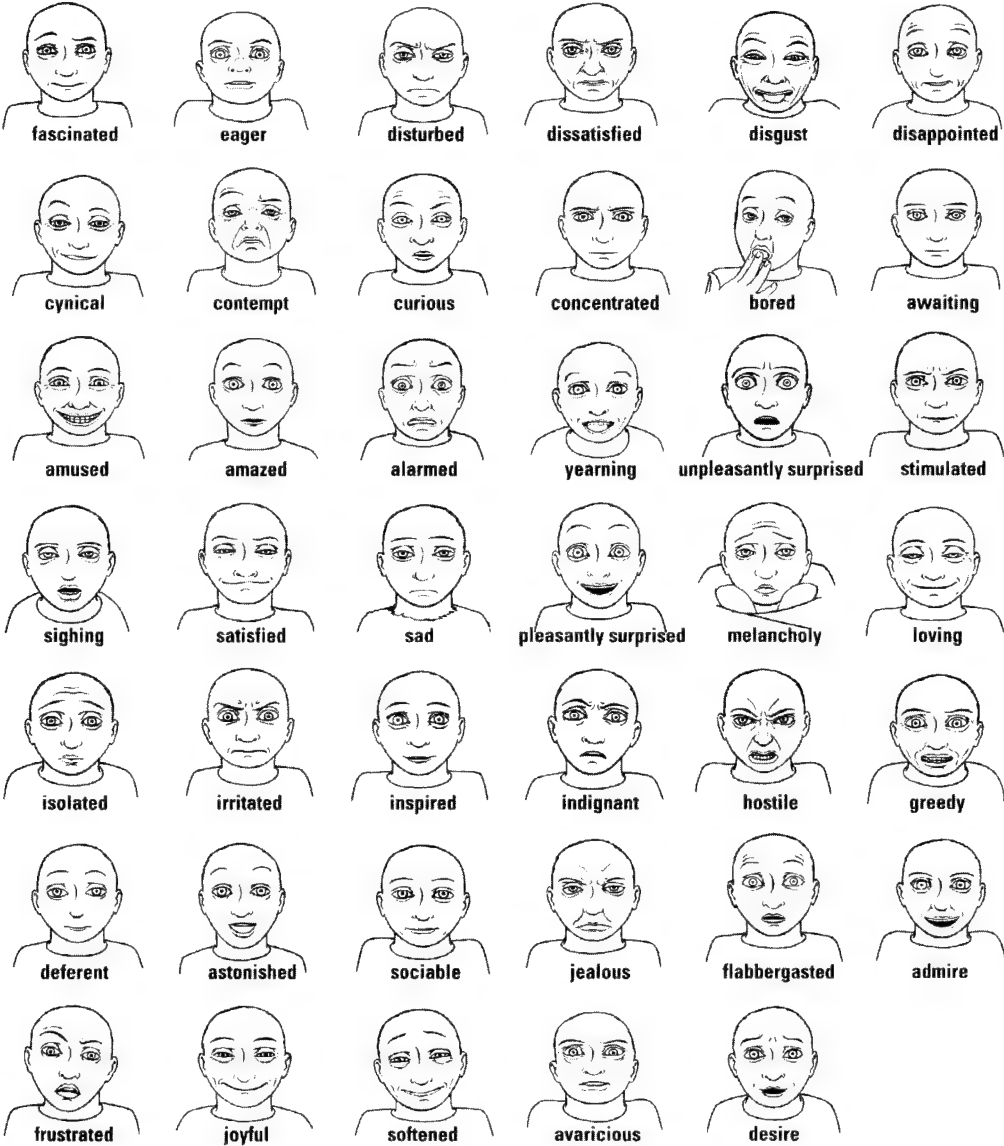
### Conclusions

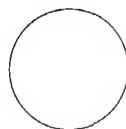
From experimenting with PrEmo-1, it was learned that facial line-drawings are promising for the self-report of emotions. It enables fast, intuitive, and pleasurable self-report. However, it was also found that it is impossible to draw faces that express merely dimensions; people will *always* read specific emotions in them. Moreover, it was found that allowing participants to select only one face is too limited. In some cases, participants want to report more (i.e. mixed) emotions. Finally, it was found that, as the faces' gender is not an issue, one version (either male or female) would have sufficed.



**Figure A2-3 Interface PrEmo; version 2.**

PrEmo-2 is a set of 41 plasticized cards, each depicting a face that portrays a distinct emotional expression. The faces represent emotions that are regularly elicited by product design. Participants can select one or more faces that, in their opinion, best portray the emotion(s) they experience.





## A2-2 PrEmo-2

### Starting points

PrEmo-2 (Figure A2-3) was developed in January 1998. At this time, the appraisal theory of emotion was introduced in the project. This theory fed the idea that distinct emotions instead of generalised dimensions should be measured. Again, the tool was based on the use of facial expressions. However, as PrEmo-1 does not support the measurement of specific emotions, it was decided not to attempt to improve the PrEmo-1 faces, but to create a new concept. Based on an extensive review of research on facial expressions, Wallbott (1998) concluded that looking at one's facial expression is sufficient to recognize how this person feels. Although this conclusion was based on studies that focussed only on small sets of basic emotions, Ekman, Friesen, and Ellsworth (1982) predicted that the same applies to non-basic emotions. Based on this prediction, it was decided to use the set of 41 distinct emotions often elicited by product appearance (developed in Chapter 2, see Figure 2-7) as the starting point for developing PrEmo-2.

### Development

A professional cartoon artist designed a face in which features that differentiate emotional expressions (i.e. eyes, eyebrows, and mouth; see Ekman, 1992) are slightly exaggerated. Note that another cartoon artist was hired than the artist who created PrEmo-1. This second cartoon artist worked on all subsequent versions of the instrument (i.e. PrEmo-2 to 6). Subsequently he drew 41 versions of this face, each portraying one of the 41 emotions. In developing these faces, the artist relied mainly on his own expertise. His creative process was supported with two 'tools:' some cartoonist-handbooks, and his own face. He used his face (and a mirror) to experiment with facial emotional expressions, which he subsequently applied in the PrEmo-2 faces. Several versions were sketched and re-sketched in pencil before the final version was drawn in ink. Each sketch version was discussed with the author, and based on this discussion new versions were created. The final versions comprise faces on which we agreed that they adequately express the targeted 41 emotions.

### Evaluation

In a small experiment, PrEmo-2 was evaluated. Ten participants performed two tasks. First, they used PrEmo-2 to report emotions elicited by (pictures of) six telephone models. Second, they were instructed to describe the emotion portrayed by each face. Subsequently in an open interview the instrument's promises and problems were discussed.

Participants reported that the faces are intuitive and pleasurable in use. They agreed that these faces enabled them to give a detailed report of their emotions

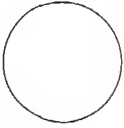
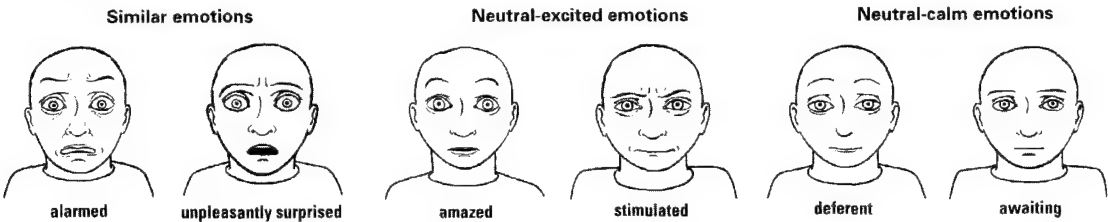


Figure A2-4 Problematic emotional expressions PrEmo-2.



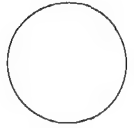
(note that all participants selected more than one face per stimulus). Some participants mentioned that these faces enabled them to report emotions that they would not have been able to report verbally ("although I know what I feel, I cannot find the words to express this feeling, but I *can* find the faces to express this feeling").

An important limitation (reported by all participants) is that the number of faces is *too big*. Because of the large number of faces, participants struggled to get an overview of the range of emotions. Moreover, the differences between the faces are reported to be too small. The result of the large amount of faces with sometimes-small differences was that participants were sometimes confused and took sometimes minutes to rate a stimulus. As a consequence, PrEmo-2 appeared to be less intuitive than PrEmo-1. It was discussed with the participants how many faces in their opinion would be necessary and sufficient to accurately report their emotions. The answers of the participants varied between 10 and 25 emotions.

The second part of the study revealed a second (related) major limitation of PrEmo-2: the facial expressions are ambiguous. The differences between some emotions had been too small to be portrayed successfully. Although the participants succeeded in labelling the faces on a general level, they were not able to correctly identify subtle differences between similar emotions (e.g. *alarmed* and *unpleasantly surprised*; *sad* and *melancholic*).

#### Discussion; facial expression of emotions

The process of developing the faces was started in the assumption that it would be possible to create distinct facial expressions for all 41 emotions. However, during the development, some complications surfaced. It was found that some emotions are difficult, if not impossible, to differentiate with facial expressions. Although, these findings are not conclusive but anecdotal, they are indicative and have influenced the development of PrEmo. Moreover, they were confirmed in the evaluation study. There appeared to be two causes for differentiation difficulties (see Figure A2-4): (1) some emotions do not (or hardly) differ in expression; (2) some emotions that do not have a distinctive emotional expression.



- (1) Some emotions have similar expressions. Examples are *sad* and *melancholy*. Although different, these emotions have the same expression. The reason might be that the difference lies in some other component of the emotion (e.g. 'feeling,' or 'appraisal'). In some other cases, emotions have different expressions, but these differences are very small. *Alarmed* and *unpleasantly surprised*, for example, come with slightly different expressions, but it seemed impossible to capture these differences in the portrayals.
- (2) We found that the neutral (i.e. neither 'pleasant' nor 'unpleasant') emotions are particularly difficult to portray. Portraying the neutral-excited emotions (e.g. *amazed* and *stimulated*) was not successful because participants always interpreted them as either pleasant or unpleasant. In the development of PrEmo-1, it was found that people cannot help but interpreting expressions in terms of distinct emotions. Apparently, the same principle applies to *valence*: we have a strong tendency to interpret a face as either pleasant or unpleasant. Both neutral-calm emotions (i.e. *awaiting* and *deferent*) appeared to be expressed by neutral 'emotionless' face. Note that most participants even interpreted this neutral face as either pleasant or unpleasant.

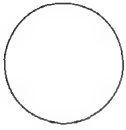
### Conclusions

It is possible to portray distinct emotions in line-drawn facial expressions. Not only the basic emotions can be portrayed, but also non-basic (more cognitive) emotions, such as *fascination*, *inspiration*, and *boredom*. These faces are promising for the measurement of distinct product emotions. Participants report that they can accurately report their (mixed) emotions with the use of such line-drawn facial expressions. However, the number of faces included in PrEmo-2 is too large. It is neither possible nor necessary to include 41 differentiated facial expressions. First, it is not possible because differences between included emotions are too small to allow unambiguous portrayals. As a result, these faces' validity is problematic. Second, it is not necessary to include all 41 emotions because participants reported that with approximately 20 faces, they would be able to report their emotions faster, more intuitive, and not less accurate.

## A2-3 PrEmo-3

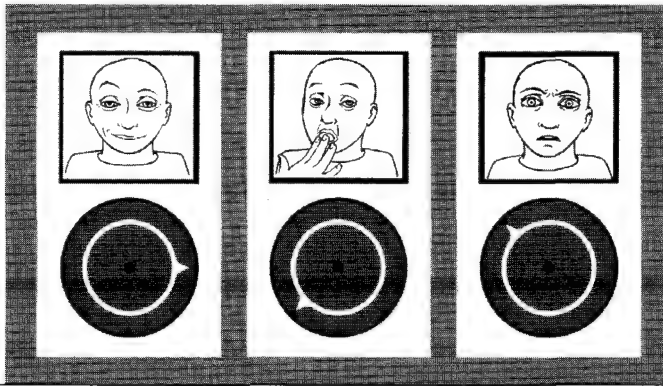
### Starting points

PrEmo-3 (see Figure A2-5), which was developed in July 1998, included a selection of the faces that had been created for PrEmo-2. Based on the PrEmo-2 evaluation, it was decided to reduce the set of measured emotions to approximately 20. The starting point for this reduction was the idea that some emotions can, and others cannot be experienced together. Emotions that cannot be experienced together are those that



**Figure A2-5 Interface PrEmo; version 3.**

A computer interface displays three line-drawn faces. Below each face, a turn-button is placed, which is used to manipulate the face's emotional expression. By turning one of the buttons, the expression of the face above it changes. Each button represents six distinct emotions and a neutral position. The buttons are modeled after the Circumplex of Emotions (see Section 1.4). Emotions on the left side of the button are 'unpleasant,' on the right side are 'pleasant.' Emotions on the top are 'excited,' those on the bottom are 'calm.' In a measurement session, participants turn the three buttons to combine a set of three facial expressions that best portray their emotion(s).



are opposite (e.g. *admiration* and *contempt*), or only differ in level of activation (e.g. *disgust* and *aversion*). If such emotion sets are found, participants can be instructed to select one emotion from each set (as opposed to selecting emotions from the total set). Furthermore, it was decided not to include any of the neutral (neither pleasant nor unpleasant) emotions.

#### Development

Three sets of six emotions were drawn from the total set of 41 emotions. This selection was based on the results of a study with 30 participants. The aim of this study was to find which of the 41 product emotions can, and which cannot be experienced together. A computerised procedure was developed that included a short introduction, an exercise, and two tasks. The first task was designed to find opposite emotions. The interface depicted one emotion from the 'average-unpleasant' category (e.g. *disappointed*), and all seven emotions of the 'average-pleasant' category. Participants were instructed to select from these seven emotions, the one that is most opposite to *disappointed*. The same procedure was repeated for the other six emotions of the 'average-unpleasant' category (the same procedure was followed for the pleasant emotions).

The second task was designed to find emotions that differ only in level of activation. Again an emotion of the unpleasant-average category was shown (e.g. *contempt*), this time with the five 'calm-unpleasant' emotions. Participants were instructed to: "If you experience 'contempt' and it becomes less intense, which

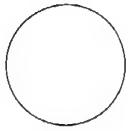
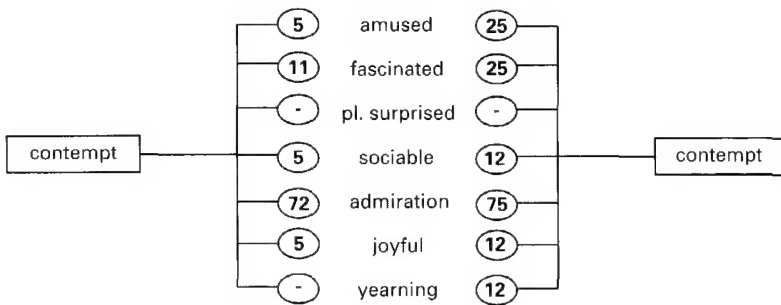


Figure A2-6 Emotion relation chart.



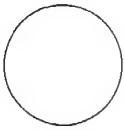
emotion of the list would best describe the emotion you are experiencing?" A similar procedure was applied for the 'excited' emotions, and for the pleasant emotions. The results of this study were depicted in 'relation charts' of the product emotions. Figure A2-6 shows an example of such a relation chart.

These charts showed that there is between participant variations in what emotions are believed to be opposite. This finding might be caused by the set emotions included in the study, i.e. it is possible that some opposites are not included (e.g. the opposite of *jealous* might be an emotion such as *happy-for*, which is not included in the set). Another explanation might be that some emotions might have more than one possible opposite. For example, it is conceivable that *boredom* is the opposite of both *fascination* and *amusement*. Given the indefinite character of the results, many alternative subsets could be drawn from the relation charts. Therefore, three independent referees were instructed to interpret these relation charts. The three sets of six emotions that have been selected are those on which the three referees agreed (see Figure A2-7).

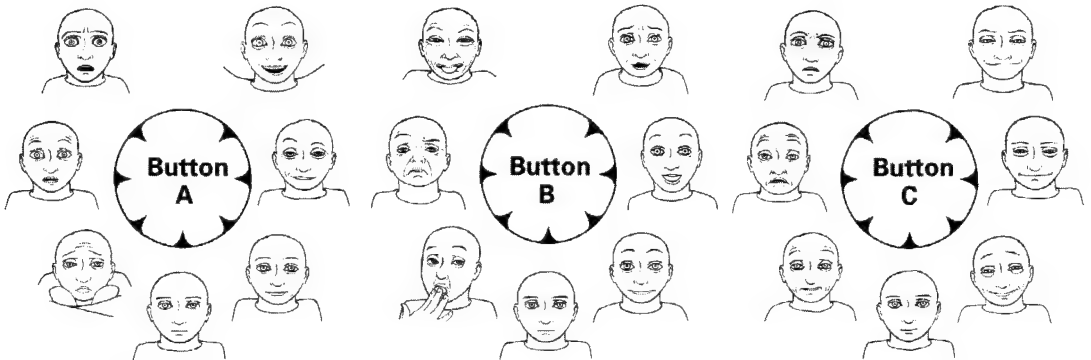
#### Evaluation

In an application study, PrEmo-3 was evaluated (see Desmet & Hekkert, 1998).

In this study, 10 participants reported their emotional responses towards four car models. It was found that (similar to PrEmo-1) after some training, participants could report their emotions fast and intuitive. Moreover, participants reported that they enjoyed operating the buttons. However, they also reported an important shortcoming of these buttons. Their experiences did not support the assumption that the emotions within buttons cannot be experienced at the same time. Most participants complained that they could only select one emotion of each button. Moreover, some participants reported that they were not certain about the expressed emotion of some faces. Some reported that the faces were rather scary because they are too realistic in combination with the big eyes.



*Figure A2-7 Three sets of emotions measured by PrEmo-3.*



#### Conclusions

The idea of mutually exclusive emotions was not convincing and should be abandoned. The number of 18 emotions is convenient and sufficient for self-report. However, the line-drawn faces are not unambiguous. Given, the similar findings in experimenting with PrEmo-2, it is concluded that these faces alone will not be sufficient for creating a valid and reliable measurement instrument.

## A2-4 PrEmo-4

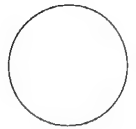
### Starting points

PrEmo-4 (see Figure A2-8) was developed in January 1999. As it was found problematic to create valid and reliable expressions of the product emotions with using only stills of facial expressions, it was decided to experiment with the use of more cues: the facial dynamics, and the bodily postures. The 18 emotions selected in the development of PrEmo-3 were also applied in PrEmo-4.

### Development

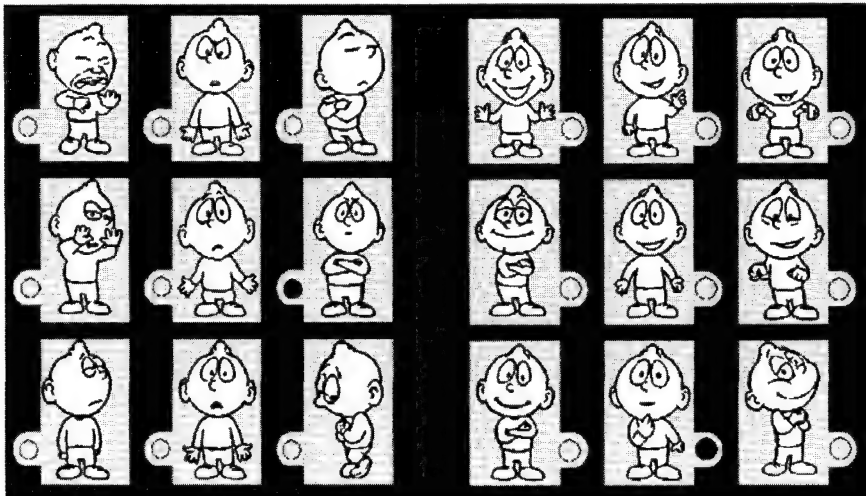
First, the cartoon artist created a character. Subsequently, he developed 18 animated versions of this puppet, each portraying a distinct emotion. These animations were based on the expressions of videotaped actors. Both the design of the character, and the development of the animated puppets are discussed in Section 3.5 of Chapter 3. It was decided to create an as simple as possible interface. Each animation is represented by the last still of the animation sequence. These 18 puppet stills are shown on a computer screen in two sections: one containing unpleasant emotions, and one containing pleasant emotion. Next to each puppet a small button is placed. Participants can use these buttons to express whether or not they feel the emotion expressed by the puppet (i.e. either 'yes' or 'no').





**Figure A2-8 Interface PrEmo; version 4.**

A computer interface depicts 18 puppets each representing a distinct emotion (nine unpleasant on the left side, and nine pleasant on the right side of the interface). The puppets are animated: when clicked on, they express an emotion, dynamic in both facial and bodily features. Participants report their emotion(s) by selecting one or more animations. An animation is selected with a bullet-tag at the puppet's side. The colour of the tag provides visual feedback of the rating (i.e., black: this animation expresses my emotion; grey: this animation does not express my emotion).



### Evaluation

Both an application and a validation study have been conducted with PrEmo-4. First, in an application study, emotions measured by 13 Japanese car models were measured (see Desmet, Hekkert, & Jacobs, 2000). This study was also used to assess the face validity of the instrument (i.e. do the participants feel that they can express their emotions with the instrument?). Second, in a test-retest procedure the validity and reliability of the PrEmo-3 puppets were measured (see DeGooijer, 1999). The results of these studies indicated both promises and shortcomings. First the results of the application study are discussed, and subsequently those of the validation study. Note that both studies are reported only briefly because similar studies with the final PrEmo version (i.e. PrEmo-6) are reported in Chapter 4 and 5 of this thesis.

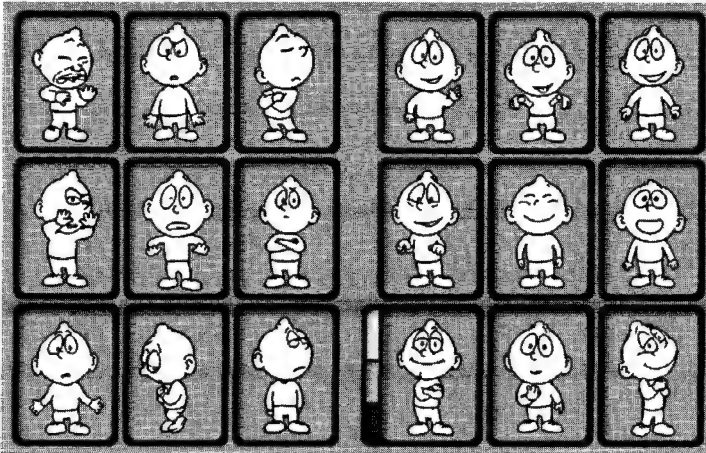
#### • Application study

Fifteen undergraduates of the Delft University participated in the application study. The face validity was promising: 13 participants reported that the instrument enabled them to report their emotional response (two participants reported that the instrument partly enabled them to report their emotions). The application study also revealed some shortcomings.

First, some shortcomings were revealed through the participants' feedback. Nine

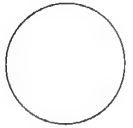
**Figure A2-9 Interface PrEmo; version 5.**

A computer interface depicts 18 puppets, each portraying a distinct emotion (nine unpleasant and nine pleasant). The puppets are animated: when clicked on, they portray the emotion, dynamic both in facial, bodily, and in vocal expression. Participants report their emotions by rating the animations with a three-point scale. When a puppet is clicked, it will first animate and subsequently a three-point scale will appear at the left side of the puppet. Visual feedback is given by the background colour of the puppets that follows the colour of the rating scale.



of the 15 participants felt that the number of animations was too big because they believed that some emotions were not relevant. Moreover, five of the participants felt that some emotions were missing (e.g. *amusement* and *admiration*). Finally, five participants reported that the two-point scale (no / yes) was too rigid and therefore frustrating. They expressed the need for a less rigid scale. An often-made remark was: "this emotion I feel somewhat, and that emotion I feel a lot, but I cannot express that with these buttons." Furthermore, the visual feedback seemed to be inadequate. Four participants requested more extensive visual feedback.

Second, some shortcomings were found by observing the participants during their rating. First, and most important, the interface encourages 'lazy rating'. An important aspect of PrEmo is the puppets' dynamic quality. In an experiment, not merely the stills, but the animated puppets should be rated. In PrEmo-4 however, participants tended to animate the puppets only when responding to the first one or two stimuli. Subsequently, they rated the ensuing stimuli without observing the dynamic portrayals. Hence, they rated the *stills* rather than the dynamic animations. As these stills cannot be considered proper representations of the emotions, this behaviour should be avoided. Preferably, participants observe the animation *each time* before rating it. Second, participants tended to develop 'favourite puppets.' Often, after responding to two or three stimuli, participants started to restrict their rating to a few puppets only. In their rating, they would use these puppets and ignore



others. This behaviour introduces unwanted effects in the resulting data. For example, sometimes emotions appeared to be elicited almost never at the same time, simply because one of them was never rated.

- *Validation study*

In the validation study, 43 participants were instructed to interpret the emotional expressions of the 18 animated puppets (the procedure of this study was identical to the study reported in Section 4.2 of Chapter 4). The results indicated that some puppets (i.e. *fascination* and *desire*) were not valid.

#### Conclusions

In this study, it was found that of the four PrEmo versions, this fourth was by far most promising. Like the previous versions, it enables self-report that is simple, fast, and unobtrusive. Moreover, and unlike the previous versions, the dynamic animations appear to be unambiguous. The validation study indicated that 16 of the 18 puppets' portrayals are valid. Given the promising evaluation results, it was decided to use this concept as the starting point for PrEmo-5.

Nevertheless, PrEmo-4 also showed some shortcomings, which must be solved by PrEmo-5. First, and most important, the application study indicated that the set emotions measured by the instrument is not optimal. This set was selected for PrEmo-3 on the basis of an assumption that was later abandoned (i.e. some emotions can and others cannot be experienced simultaneously). Participants report that some emotions are redundant (e.g. *attracted to*) and others are missing (e.g. *amusement* and *admiration*). Moreover, the instrument's interface showed some deficiencies (e.g. the two-point scale is too limited, and the interface stimulates 'lazy rating').

## A2-5 PrEmo-5

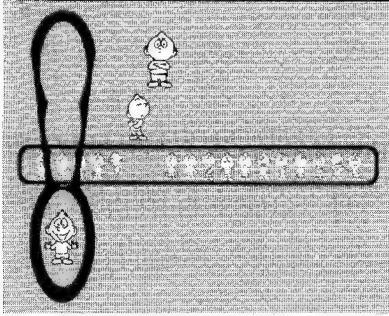
### Starting points

PrEmo-5 (see Figure A2-9) was developed in February 2000. To increase the validity of the puppets, it was decided to include one extra cue: vocal expression of emotions. A more appropriate set of emotions was selected from the 41 product emotions. Moreover, the instrument's interface was redesigned to overcome the deficiencies found in experiments with the previous version.

### Development

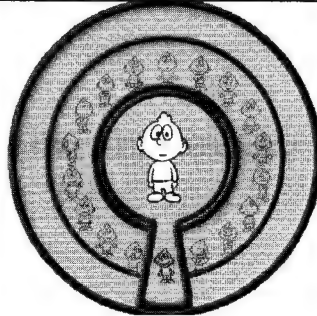
First, a new set of emotions was selected from the 41 product emotions. The selection of this set is discussed in Section 3.4 of Chapter 3. Second, to overcome the deficiencies of the instrument's interface, some ideas for alternative interfaces have

Figure A2-10 Three PrEmo-5 interface concepts.



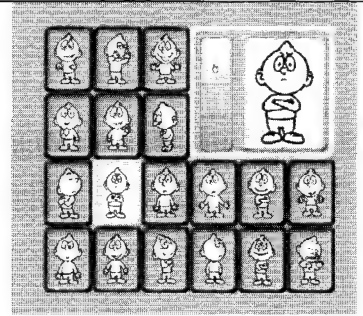
Concept 2: viewmaster

Puppet stills of the animations are arranged along a circle. Participants can turn this circle with the input-device. When the circle is stopped, the puppet at the bottom will portray its emotion in the wheel's center. To select a puppet, participants move it down with the input-device. The puppet is subsequently placed in the outer circle.



Concept 1: thermometer

Puppet stills of the animations are arranged on a horizontal line. Participants report their emotions with the use of an input-device 'thermometer,' which is shown on the left side of the interface. When the thermometer is placed on top of one of the stills, the puppet in the lower part of the thermometer will express the accompanying portrayal. Subsequently, participants can rate the puppet by using the input-device to move the still upwards.



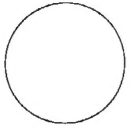
Concept 3: Mosaic

This concept is based on the use of a touch screen. Puppet stills are divided over a number of cells. When participants touch a still, the puppet in the upper right corner will portray the corresponding emotion. To the left of this portraying puppet, a gliding scale is depicted. As soon as the puppet has finished portraying the emotion, participants can use the scale to rate it. Visual feedback is given by the background-colour of the corresponding still.

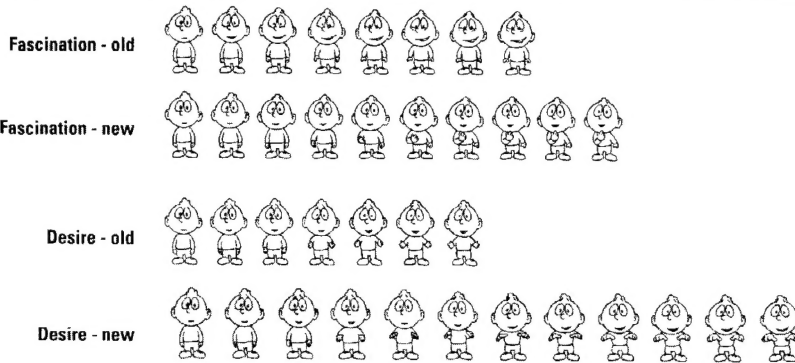
been produced. Three of these interface ideas have been developed into working prototypes (see Figure A2-10). Although none of these prototypes has been adopted for PrEmo-5, developing and exploring them provided important insights on how to overcome PrEmo-4's deficiencies. It was decided not to adopt a new concept but to PrEmo4 as the starting point, and improve its interface. It was adjusted on the following features:

- *Limited 'yes – no' rating.* Three-point scales have replaced the rating buttons.
- *'Lazy rating.'* The rating scales are hidden behind the puppets. They appear after a puppet is clicked. In that way, participants are 'forced' to look at an animated puppet before it can be rated.
- *Rating only 'favourite' puppets.* Participants are instructed to rate all puppets. The interface allows them to commence to the next stimulus only after all puppets have been rated.

Third, sounds were developed, again with actors. A professional voice actor created the final sounds in a sound studio (see Section 3.5). The fourth and final step in the development of PrEmo-5 was the redrawing of two animations (i.e. *fascination*, and *desire*). The new animations were based on a re-evaluation of the expressions of the actors (see Section 3.5). The stills included in both the old and new versions are depicted in Figure A2-11.



**Figure A2-11 Old and new animated fascination and desire.**



### Evaluation

PrEMO-5 was applied in a cross-cultural study in which emotions measured by six car models were measured in Japan and in the Netherlands. This study is reported in Chapter 5. Many participants reported that the number of emotions is too big. Moreover, some emotions seemed to be irrelevant: vulnerable and softened. Moreover, two pairs of emotions showed high correlation: *attracted to* and *desire*, and *aversion* and *disgust*.

### Conclusions

PrEMO-5 purports to measure product emotions fast and intuitive. Moreover, the method is valid and reliable. Based on these findings it was decided to omit four emotions, which resulted in the final version of PrEmo: PrEMO-6 (see Section 3.6).

# Acknowledgements



I acknowledge Jan Jacobs, Paul Hekkert, and Kees Overbeeke for providing me with the possibility to write this thesis. Jan, your focus on the main issues -more than once- pushed me back on track when I was dangerously lured by one of the many side roads. Paul, thank you for your guidance which was shaped by a clear-cut commitment to quality. I cherish the memory of our visit to Japan, which has been a highlight of the past few years, and I look forward to our future projects. Kees, thank you for showing your trust in me at moments it was needed most.

The Designing Emotions research project was made possible by the generous support of Mitsubishi Motors Corporation. Mr. Nakamura, Mr. Honda, Mr. Nakanishi, Mr. Mir, and Mr. Cazzato, our meetings have been both inspiring and motivating. I hope that, rather than an ending, this thesis marks the start of many more fruitful projects to come.

In the course of time, many contributed to my research. René van Egmond has been a tremendous help in issues of methodology and verbal clarity. The inspiring discussions with Ed Tan helped me to grasp the traditions in emotion research. Jeroen van Erp provided me with the opportunity to organize the 'body cleanser' workshop and was responsible for the creation of the working [p&e] navigator. Peter Wassink's skillfully drawn animations have proven to be essential to my research. The vocal expressions were recorded at Bob Kommer sound studio. Matthijs van Dijk and the other members of the Design & Emotion Society forced me to relate my research to design practice. Rick Schifferstein supported me on both statistical and social issues. Seunghee Lee has done valuable work on the Japanese emotional expressions. Sanne van Rooij created the perfect look for this thesis, and Ruth Green corrected the English.

I acknowledge all others who supported, inspired, or challenged me. The designers of Fabrique who were involved in the development of the [p&e] navigator created a navigator that is both elegant and efficient. The colleagues of the Studiolab who have been valuable partners for discussion. The participants of the photo project, the designers and tutors of the workshops, and the actors who contributed to the development of the PrEmo animations. In addition I want to acknowledge the students who contributed, especially Florentine, Petrik, Cees, Frank and Ties. I hope the project has been as inspiring for you as it was for me.

Naturally, I acknowledge family and friends for their support and patience when -more than once- I wasn't around because my research 'needed me.' Mariska, Wim, Jochen, Pablo, Simone, Charles, and many others, thanks for pulling me through. Gregor, thank you for your support and unlimited patience. And finally, GIO - Robert, Nicole, and Danielle, it was a privilege to share with you these five years of lessons in life. Indeed, like reason, our research is -and ought to be- a slave of our passions.



# List of Publications

- Desmet, P.M.A. (1999a). To love and not to Love: Why do products elicit mixed emotions? In C.J. Overbeeke & P. Hekkert (Eds.), *Proceedings of the international conference Design and Emotion* (pp. 67-74). Delft, The Netherlands: Delft University of Technology.
- Desmet, P.M.A. (1999b). Emotion through expression; designing mobile telephones with an emotional fit. In A. Harada (Ed.), *Report of Modeling the Evaluation Structure of KANSEI* (vol. 3, pp. 103-110). Tsukuba, Japan: University of Tsukuba.
- Desmet, P.M.A. (in press). From disgust to desire: how products elicit emotions. In P. Hekkert & D.C. McDonagh (Eds.), *Proceedings of the third international conference Design and Emotion*. Loughborough, England: Loughborough University.
- Desmet, P.M.A., & Hekkert, P. (1998). Emotional reactions elicited by car design: A measurement tool for designers. In D. Roller (Ed.), *Automotive Mechatronics Design and Engineering* (pp. 237-244). Düsseldorf, Germany: ISATA.
- Desmet, P.M.A., & Hekkert, P. (in press). The basis of product emotions. In W. Green & P. Jordan (Eds.), *Pleasure with Products, beyond usability*. London, England: Taylor & Francis.
- Desmet, P.M.A., Hekkert, P., & Jacobs, J.J. (2000). When a car makes you smile: Development and application of an instrument to measure product emotions. In: S.J. Hoch & R.J. Meyer (Eds.), *Advances in Consumer Research* (vol. 27, pp. 111-117). Provo, UT: Association for Consumer Research.
- Desmet, P.M.A., Overbeeke, C.J., & Tax, S.J.E.T. (2001). Designing products with added emotional value; development and application of an approach for research through design. *The Design Journal*, 4(1), 32-47.

## In Dutch

- Desmet, P.M.A. (1997). Als je voelt wat ik bedoel. *Vormberichten*, 4, 18-20.
- Desmet, P.M.A. (1998). Liefde voor het product: Een onderzoek naar de gevoelsmatige reactie op producten. In: *i.d. Jaarboek 1998*. Delft: Studievereniging i.d.
- Desmet, P.M.A. (2000). Product en Emoties; greep krijgen op het ongrijpbare. *Product; tijdschrift voor productontwikkeling*, 2, 32-36.
- Desmet, P.M.A., & Rijcken, T. (2001). Furby is dood, lang leve Furby; ontwerpers over product en emotie. *Product; tijdschrift voor productontwikkeling*, 1, 2-7.

# Curriculum Vitae



Pieter Desmet was born in Izegem (Belgium) in 1972. Following his secondary school education at the Stanislas College in Delft, he started his studies of Industrial Design Engineering at Delft University of Technology in 1990. In 1996 he received his master's degree with distinction (annual best project award). In 1997, he started his PhD research at the Department of Industrial Design Engineering at Delft University. The research objective of his PhD project was to develop tools that support designers in getting to grips with the emotional impact of their designs. He presented his research at several international conferences, and published amongst others in the *Advances of Consumer Research* and the *Design Journal*. In addition, he is a frequent contributor to magazines in the field of product design.

Pieter is board member of the international Design and Emotion Society. For this society he co-organised design workshops in Delft (The Netherlands), Potsdam (Germany), and Porto (Portugal). Next to his research and education activities, he initiated and produced a national design-meets-poetry project. In this project designers and poets interact and explore the similarities and differences of human expression in shapes and words.